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Table of Contents

| | |
|---|----|
| From The Editor, KI6DS | 2 |
| Doug Hendricks, KI6DS | |
| What Can You Do With A 10 Meter Pole? | 3 |
| Ed Manuel, N5EM | |
| Interfacing an external headset to the FT817 | 23 |
| Graham Firth, G3MFJ | |
| Interfacing PSK31 to the FT817 | 28 |
| Graham Firth, G3MFJ | |
| Gel-Cell Charger 700 mA Max - 2001 version | 31 |
| Bill Hickox, K5BDZ | |
| QRPing with the TunaTin 2 and the SMK-1 | 35 |
| Robert Chapman, W9JOP/4 | |
| Wilderness Sierra SWR Indicator | 37 |
| Kory Hamzeh, AC6RN | |
| VXO and Buffer Amplifier, For driving Tube Rigs | 40 |
| Wayne McFee, NB6M | |
| Extend the SMK-1's TX tuning range, And clean up the TX note | 42 |
| Wayne McFee, NB6M | |
| A Short Guide to Harmonic Filters for QRP Transmitter Output | 48 |
| Rev. George Dobbs, G3RJV | |
| Homebrew a 4 - 1 Balun | 53 |
| Mike Martell, N1HXN | |
| Five Watt Dummy Load | 55 |
| Monty Northrup, N5FC | |
| QRP Dummy Load With Built-in RF Detector | 58 |
| Monty Northrup, N5FC | |
| QRP Operating | 64 |
| Richard Fisher, KI6SN | |
| From the Editor, KI6DS | |
| Enjoy the issue!! 72, Doug | |

WHAT CAN YOU DO WITH A 10-METER POLE?

Ed Manuel, N5EM

Amateur radio operators are fascinated by antennas. We are always searching for a sky-wire that will outperform whatever we have up today. While at Dayton a few years ago, I came across the DK9SQ 10-meter mast. As I played with this mast it became apparent to me that this device presented unique opportunities for the amateur operating from portable locations.

There are many masts available for the amateur today. One can find military surplus, high tech aluminum, simple fishing poles, painter's poles, electrical lineman's poles, etc. What makes the DK9SQ (and also the MFJ) 10 meter pole especially attractive is that, in addition to its nearly 33-foot length, it collapses into a highly portable, lightweight device that is under 4 feet long. That is important to a hiker or backpacker as it can be strapped to the side of a pack frame. For the car camper, it is much easier to put this pole in your trunk or backseat than many of the longer poles.

The DK9SQ mast is made from fiberglass and is a non-conductor. It does not require special considerations for insulation or interaction with antennas that are supported by it. The length of 10 meters seems to be the largest pole of this type available today. At nearly 33 feet long, this is a substantial item. It is not easily erected in high winds. The wind-load of such a long structure is significant. Fortunately, my use of this antenna support is for portable and temporary antennas. I generally will not try to get on the air if the conditions are unfavorable. Many hams with which I have spoken brave the elements with this mast. One just has to consider the environment to have fun.

The 10-meter pole immediately suggests vertical antennas. This is the most obvious use from a visual stand-

point - the pole is a tall vertical support. A 40-meter vertical is simply a wire from bottom to top with a small loading inductor (The 10-meter pole is actually 9.93 meters - 32 feet 7 inches. A quarter wavelength at 7.040 kHz is 33.25 feet.).

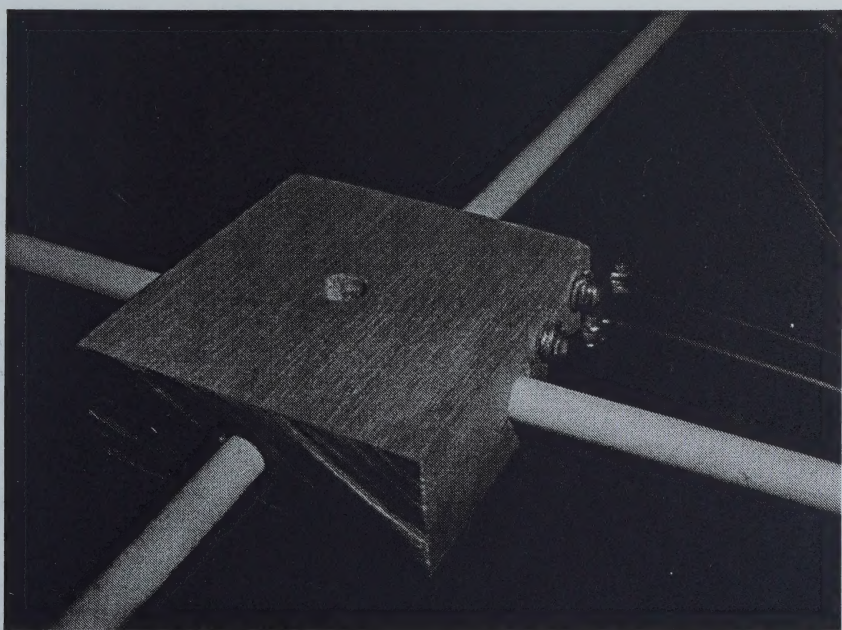
A few personal considerations are important when discussing any antenna configuration. I have already mentioned that I prefer using the mast as a portable or temporary support. Additionally, I generally desire good DX performance. That translates into low angles of radiation. Given that the support is only 33 feet tall, horizontal antennas on the bands below 20 meters will not generally give low angles of radiation at this low height. Vertical antennas will provide better DX performance. As the operating band is increased, it becomes possible to use horizontally polarized antennas to good DX effect.

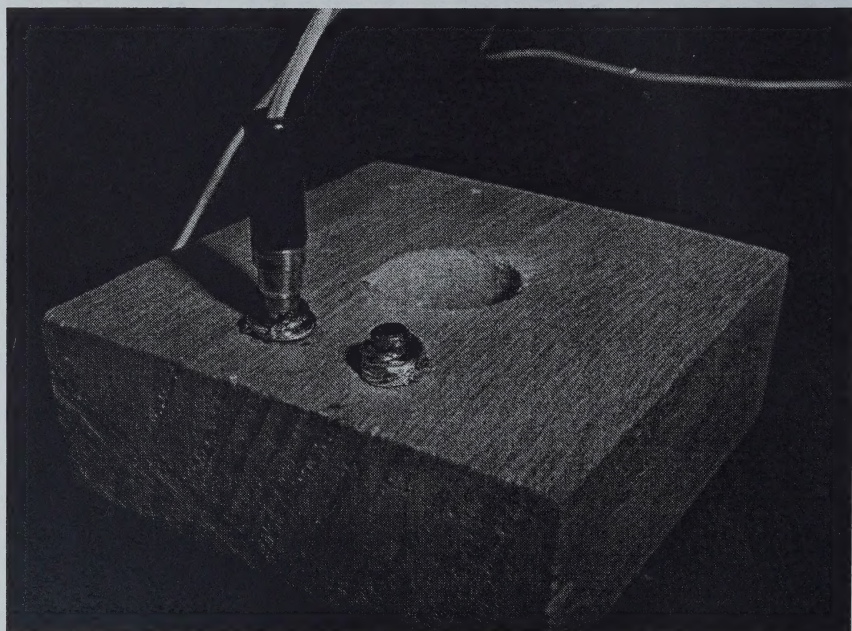
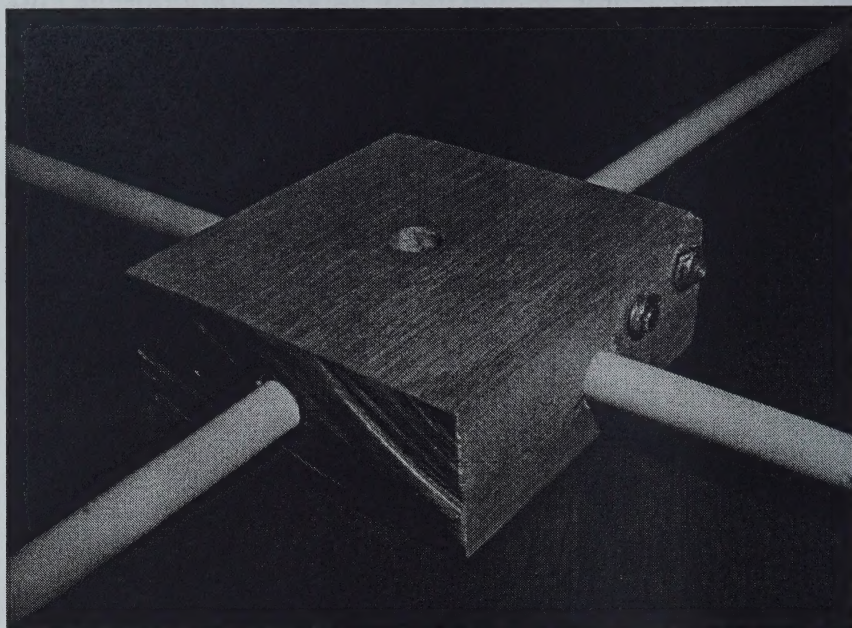
When considering an antenna configuration that is limited or based on an available support, the best performance can be obtained if the entire mast is used. That is, if there is a way to use the entire aperture of the mast, the highest radiated signal will be obtained. At 40 meters, the pole supports a quarter-wave vertical or, perhaps, a loaded half-wave antenna. The 10-meter limitation does not allow us to obtain any gain over a conventional vertical or dipole. But at higher frequencies this should be a consideration. At 10-meters where a half-wavelength is approximately 5 meters, it becomes possible to create antennas that have gain over a half-wave dipole.

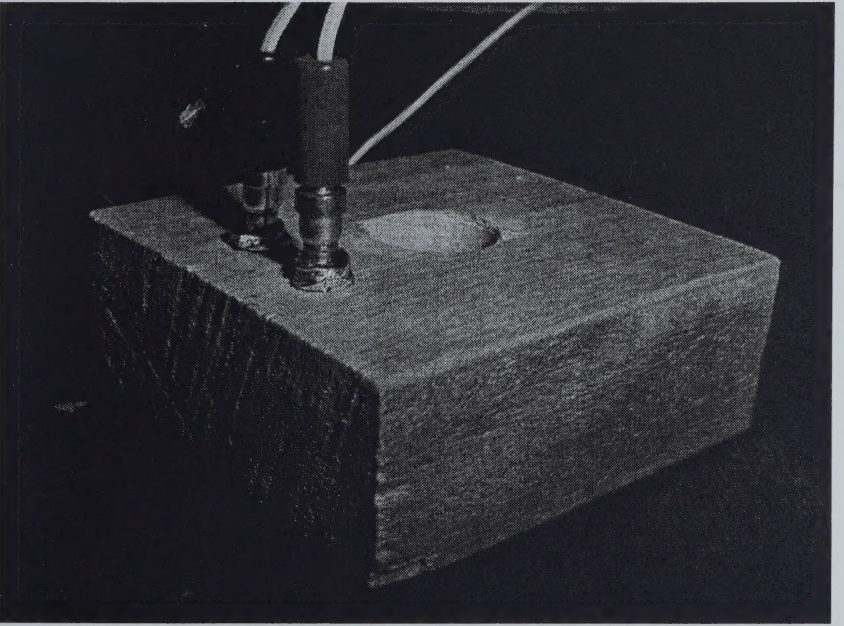
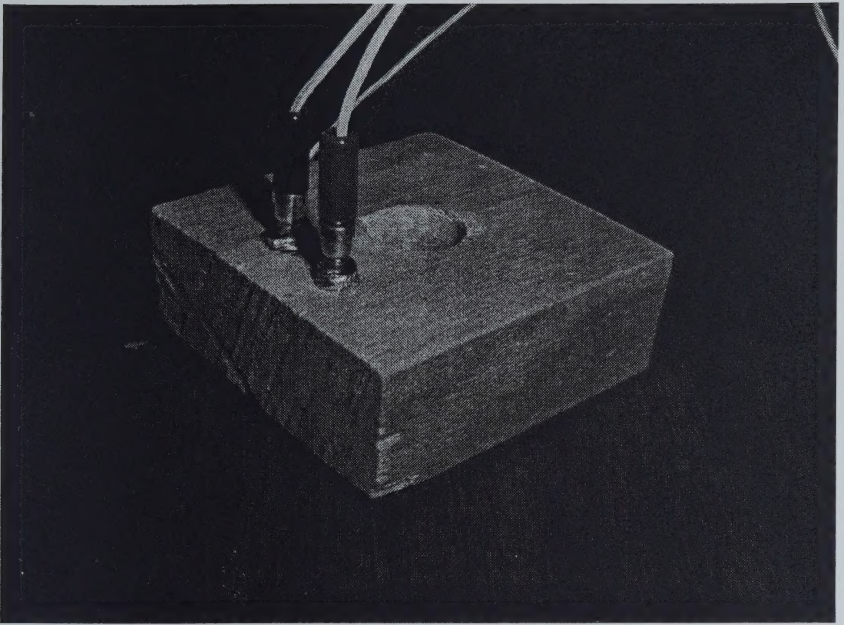
In experimenting with antennas using a long pole, it is desirable to be able to create different configurations, using lengths of wire, inductors, capacitors, traps, phasing lines, etc. and be able to easily configure these items in different locations on the mast. One might want to experiment with a base loading arrangement one day, then try a center loaded one the next. To make this kind of experimentation easier, I developed a small, wooden mounting

block that facilitates adding these various components into different configurations.

The 10-meter mast is comprised of 10, tapered sections. Fortunately, the taper on these sections is very gentle. I prefer to install my blocks sitting right on the top of a section. This requires drilling a hole that corresponds to the ID of the lower section (OD of the upper section). A verbal description of these blocks becomes very complicated so I refer you to the attached photo of several of these. I make these blocks out of whatever 2x4 material is lying around as scrap. Use a table saw to make the sections perfectly square. Mine are relatively small - and therefore lightweight. You can put a number of these on the mast without significantly adding weight or wind load. A typical vertical antenna may only require one or two of these, but having a set of them for most of the junctions on the mast makes future experimentation a snap. It's easy to make a bunch once you get the table saw setup.







After we have made the blocks and drilled them for our different mast diameters, we need some way to conveniently attach antenna wires and components. The familiar banana plug is a useful component for plug and play antenna work. In particular, I like the mini-banana plugs. Rather than the larger 0.75-inch spacing between jacks, the dual mini-banana plugs are on 0.5-inch centers. I like the more compact arrangement. You could of course use any method that allows you to be creative. I could not find a supply of dual, mini-banana

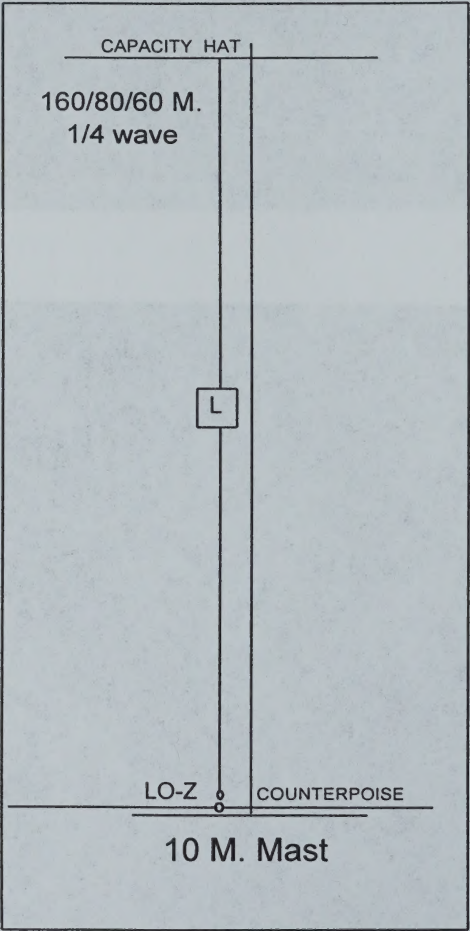


Figure 1

jacks when working on this project and came up with a more useful solution. One-eight inch brass tubing is the perfect ID for the mini-banana jack. By installing two lengths through your block, carefully spaced 0.5-inch apart, you have a dual jack on the top and on the bottom of the jack. By examining the photos you will see how useful an arrangement this is.

The top block is made differently. Instead of installing the brass tubing in a vertical arrangement, I chose to install it horizontally. The top block is specially used in certain configurations to support a capacity hat to top load some verticals and to support some special antennas on the higher bands. More on that later.

Now, let's start at the beginning, as they say and talk about specific antennas that can be use with our 10-meter mast.

160 Meters

One might question the success to be had with a short vertical, especially in portable operations, for 160 meters. On the other hand, portable operation often takes us to places that allow extravagances we may not have at home. We should all know that quarter-wavelength verticals (and anything electrically shorter) are fundamentally dependent on the ground under them. Ground losses can become a significant part of the total radiation resistance our transmitter sees. One way to help overcome this basic limitation is to use a set of radials or counterpoise wires. The problem is that a few wires help, but not a lot. To really start to see the benefit studies indicate that we need to exceed 8, and better yet, 12 radials to start bring down that ground loss. Another problem is that the low angles of radiation that we would really like to have for good DX performance are a function of the conductivity of the ground as well. The problem of radiation resistance is a close in problem. The radials within one-eighth wavelength of the antenna significantly help this problem. As

to low angle of radiation, that is a contribution of the ground conductivity significantly further out - and there isn't much we can do about it. Well, not short of operating on the beach - always a good idea!

But remember one absolute rule of antennas. Something is always better than nothing. So, if a short vertical is all we can manage and we want to operate 160 meters, then a short vertical it is.

If we are going to make the best of a short vertical for 160 meters we need to be smart and make the best use of our 10-meter mast. First of all, we want the inductor as high as possible - probably in the middle of the mast. The inductor will be larger there, but the efficiency goes up significantly over base loading. Second, we want to use capacitive top-loading. These two techniques, along with as many ground radials as you care to carry and deploy will provide the best single support antenna that our pole can provide.

If you want a better solution and have a support for the loose end of the antenna, an inverted-L configuration will be great. This antenna retains the vertical polarization but relies on the length of the top section to attain resonance. Remember that the same requirements for good ground apply to the inverted-L as to the short monopole.

80 meter (60 meters)

While these bands are higher, the same basic limitations guide us to the same antennas as on 160 meters. Of course, we require less loading inductance and our 10-meter length provides higher and higher efficiencies as we go up in frequency. On the new 60 meter band, a full length quarter wavelength is only 15 meters. We should be able to perform very well with our 10-meter antenna, loaded to become the electrical equivalent of the required 15 meters. Again, use top loading first, then add inductance as required. That will provide the best efficiency.

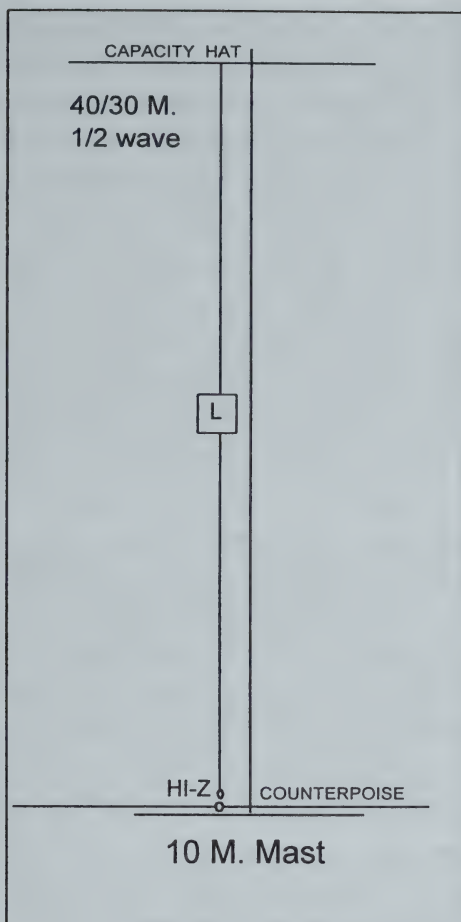


Figure 2

40 meters

At 40 meters and above, the natural length of our pole really starts to shine. As pointed out earlier, a nearly full-length quarter wave antenna can be erected with only minimal loading required. This antenna, over a proper counterpoise system will do well, given the limitations imposed by the local ground. Again, even with the higher efficiency gained by a full size antenna, our monopole will always be dependent on the ground for its low angle radiation performance.

There is another possibility. Consider the half wave antenna for a moment. An end-fed, half wavelength antenna is

a complete antenna, requiring only a minor counterpoise to function as a highly efficient radiator. (In fact, recent empirical work done by Wes Hayward indicates that the presence or absence of a counterpoise does not necessarily create problems: <http://www.easystreet.com/~w7zoi/endfeed.html>). The antenna feed point presents a high impedance requiring a matching network at the base but this problem is easily solved by a simple tuner. If we had room for a full size antenna (approximately 20 meters) this would clearly be a superior radiator. Unfortunately, we have only half that space. But, if we chose to center load the quarter wavelength radiator and apply the same capacity hat loading we used for the lower bands, it would certainly be possible to make our pole look electrically as a half wave. Heck, we already did that when we tuned it to 80 meters! So, ultimately, we have a choice to make. Should we use the quarter wave monopole, requiring a counterpoise to achieve good efficiency, or do we apply loading to achieve an electrical half wave - relying on the independence from ground to balance the losses we introduce to load the antenna. I will tell you that my preference is to use the half wave antenna. But, having a choice provides more options for us. If you are on top of solid rock (a good example being the Texas hill country), the half wave antenna would probably be a better choice. On the other hand, if you are operating from the beach, go for the quarter wave antenna.

Remember one other thing. The far field effects of ground on the angle of radiation are independent of the type of vertical antenna chosen. Keep these two effects of ground (efficiency/radiation resistance and low take-off angle) separate when evaluating your choices.

30 meters

Again, we have the same choices as on 40 meters. We can deploy a full-size, quarter wavelength vertical - even choosing to elevate the feed point 7 feet above ground

or we can provide loading to make the full length of our mast look electrically like a half wavelength radiator. Here, the choice is not so clear. An elevated feed point allows the counterpoise system to be removed from close proximity from ground. This enhances its performance, particularly for a small counterpoise system (2 - 4 radial wires). Our antenna now could be called a ground plane antenna, since we are providing the artificial ground. This is clearly the easiest to deploy, not requiring any loading to achieve resonance. Still, the half wave resonator could be used and might be a better choice in some locations where any radial wire might be a nuisance. Again, the good news is that we have choices.

20 meters

At 20 meters, the picture clearly changes. Now, we can deploy a full size half wavelength wire on our 10-meter mast. Clearly, this is the easiest to implement and takes full advantage of our support. But we could also deploy our ground plane (monopole with elevated feed and counterpoise system) to good effect. The circumstances or your particular situation will dictate whether one might be a better choice than the other.

There is another possibility that should not be overlooked. At 20 meters, our pole is a full half wavelength. Horizontally polarized antennas start to provide better low angle performance at these heights. Our vertical will probably still provide better DX performance, but a dipole or inverted-V antenna will be an adequate solution. Also, we now have the vertical room to deploy a delta loop. The bottom of the loop will be 12 feet above the ground. This is an excellent choice but does require that the ends of the delta loop be pulled out with lightweight cord and staked out. If one is careful, this can be done without putting downward pressure on the mast and causing it to collapse.

There is a downside to feeding antennas with elevated or top feed points. A 10-meter length of conventional coaxial

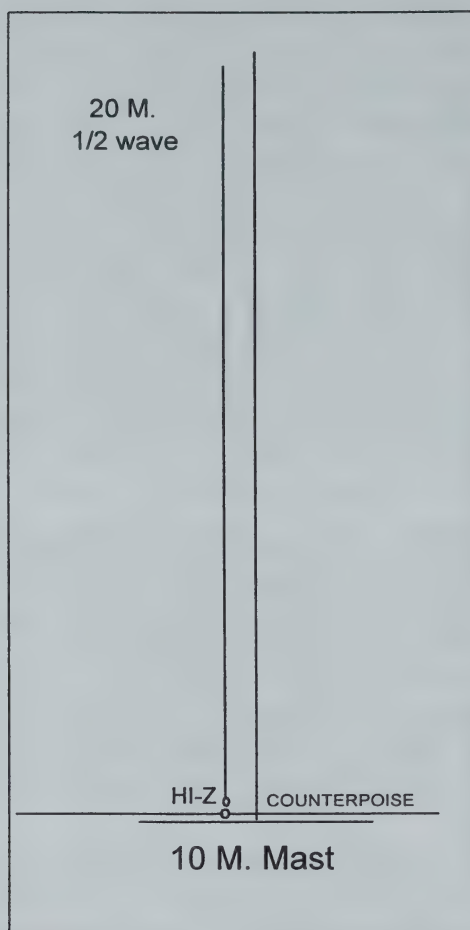


Figure 3

feed line will be somewhat lossy (RG-174) or heavy. A good solution here would be to use a length of 300-ohm twinlead or ladder line and a tuner with a balance output (I prefer an Emtech ZM-2 Z-Match). This provides both a low-loss arrangement and a lightweight one.

Additionally, the very popular NorCal Doublet is made from inexpensive ribbon cable and uses that same ribbon cable as a relatively low-loss feedline. It can be made for pocket change and packed in a Zip-Lock sandwich bag. Details of its construction can be found in previous issues

of QRPp, the quarterly publication of the Northern California QRP Club (NorCal). The use of a doublet antenna does require that we support the ends with lightweight cord. This requires additional supports or an inverted-V arrangement.

17 meters

The only difference between 20 meters and 17 meters is one of degree. Everything that can be done on 20 will work on 17. One excellent antenna is the elevated feed half-wavelength vertical. The feed-point will be 7 feet above the ground, isolating the counterpoise from real ground.

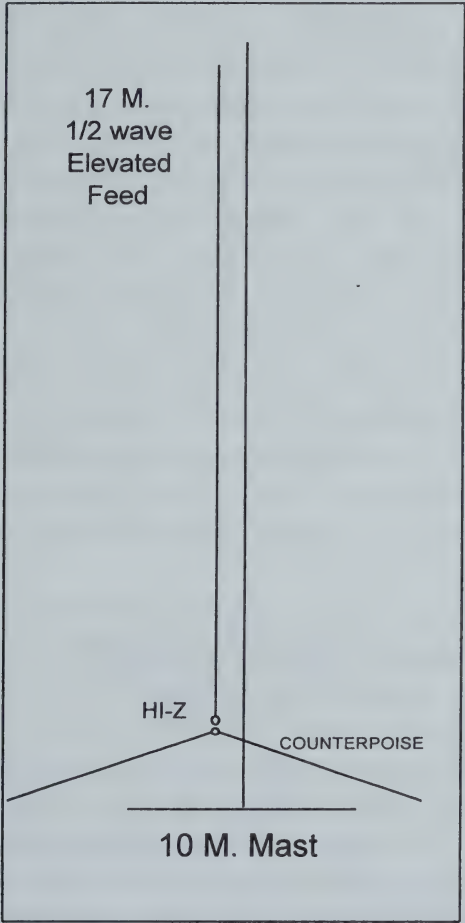


Figure 4

Another variation is the full wave loop. On 20 meters, we needed to use the Delta loop configuration but here we can deploy a full four-sided loop, erected as a diamond. With the bottom of the diamond over 12 feet above ground, we can take advantage of the pattern of the loop to good effect.

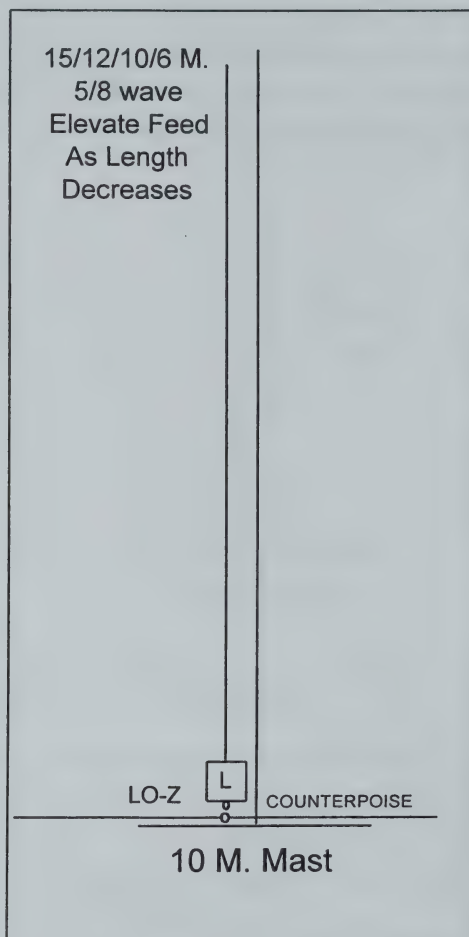


Figure 5

15 meters

At 15 meters a new configuration is added to the already growing list. Not too many hams are familiar with

the 5/8 wavelength vertical at HF. Common on VHF, this antenna has the unique property of having the lowest angle of radiation of any single element antenna. Of course, the impedance is not convenient. The 5/8 wave antenna is loaded at the base with a small inductor until it appears electrically to be a $3/4$ wave antenna. This naturally matches to a 50-ohm feed-line. Remember that the 5/8 wave antenna requires the presence of ground to become a complete structure. In that respect, it's like the quarter-wave monopole. At 15 meters, the length of the radiator is approximately 27.8 feet, requiring nearly all the mast. Still, its natural low angle radiation will serve the DXer well.

(Note: Subsequent discussion of the length of a 5/8 wave radiator has brought forth some questions. On the one hand, a well respected QRPer has suggested that the magic 5/8 wavelength can be obtained using loading, not requiring the full physical length. On the other hand, a broadcast engineer has said that it is the current distribution over the entire length of wire that gives the low angle of radiation. I do not have a definitive answer. However, I certainly have an opinion! In the absence of actual field strength measurements (that will certainly be a project) I think that modeling could provide answers. I think that the benefits to be gained going from a half wave to a 5/8 wave radiator will not be achieved unless the physical length is actually there.)

Now, a radical change in thought process. It is possible to assemble small, lightweight beam antennas using wire as the elements. Most of us think of HF beams as huge structures that are heavy. There has been certain work done to develop directional beams that defy our conventional notions. One of these is the VK2ABQ button beam. This antenna is equivalent in size to a horizontal full wave loop. It is possible to reduce the size of this antenna by folding the elements. If you review the diagram you will see the possibilities of having a two element beam that is small enough and light enough

to sit atop the 10-meter pole and be rotated by turning the bottom of the pole. And, you can pack the whole thing in a space four-feet long and about 4 inches in diameter.

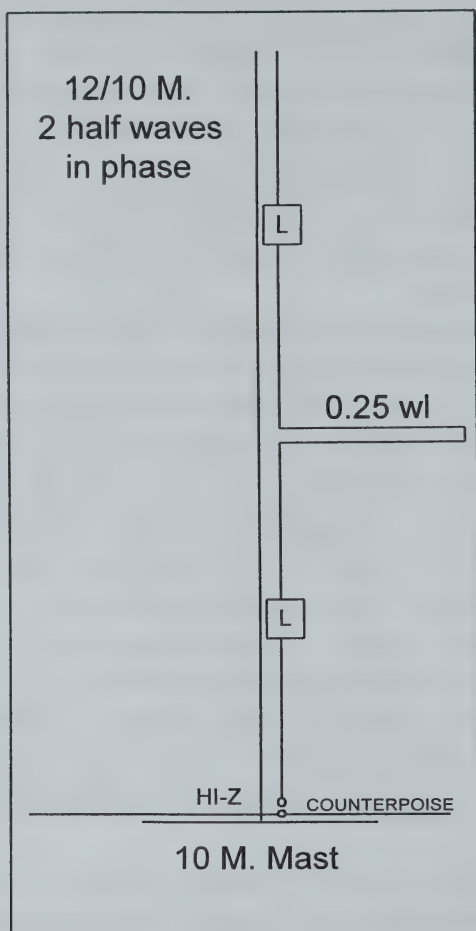


Figure 6

12 meters

At 12 meters we have even more possibilities. Consider that a half wave antenna is approximately 6 meters long. Our pole is 10 meters long. If we were to stack two half waves, we would need 12 meters. By loading each segment we can electrically have our two half waves. By phasing these

two together and feeding at the bottom, we can have gain over a dipole. We are using the entire length or aperture of the mast to our full advantage.

We really have some choices now. We can make a small two element beam from wire and have it $5/6$ wave lengths above ground (Figure 7), or we can have a vertical antenna with great low angle radiation and gain. How sweet it is.

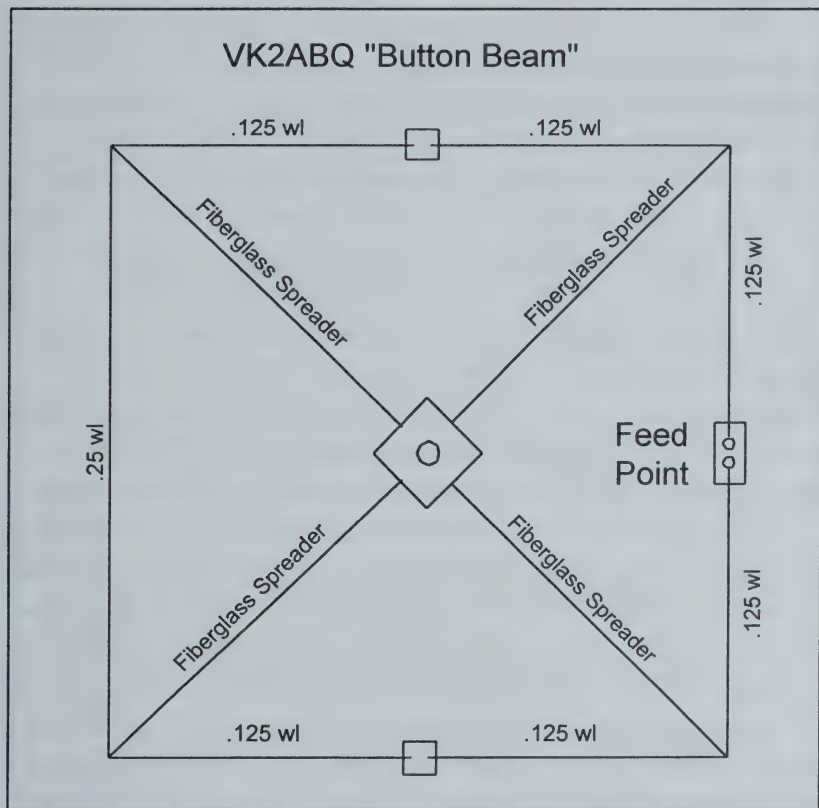


Figure 7

10 meters

There is no real difference between 10 meters and 12 meters, except that we don't require as much loading for the phased vertical segments as we do on 12.

6 meters

Of course we can do the same things on 6. Our two-element wire beam gets even smaller and lighter and its now $5/3$ wavelengths above ground. And, we now have room for three stacked half wavelength segments, providing even more gain than the two half waves in phase.

2 meters

On 2 meters we now are more interested in supporting an antenna than deploying it along the mast. There is certainly no reason why one can't create a wire antenna of stacked/phased sections but the real advantage on 2 meters is that we can get a small antenna up around 30 feet above the ground. Typical antennas that we might use are small beams and ground planes. Consider also that for sideband work, a small horizontally polarized loop style antenna would provide a better solution working terrestrial sideband stations. For low-weight, highly portable solutions, a good solution is the coaxial dipole if vertical polarization is all that is needed (FM and repeaters). That antenna can be stored in a baggie and weighs only a few ounces.

The immediate problem on 2 meters is the choice of feed-line. If we choose RG-174 we get low weight, and lots of loss. If we pick RG-58, we get tolerable loss but too much weight. While carrying 30 - 35 feet of RG-58 isn't necessarily a big problem, the weight hanging from the DK9SQ mast will be a problem. A very good solution would be to use a piece of 300 ohm twin-lead, carefully cut to be a multiple of a half-wavelength at 2 meters. This will provide a lightweight, low-loss solution. It does not matter what the feed-point impedance of the antenna is; the feed-line repeats it from load to source.

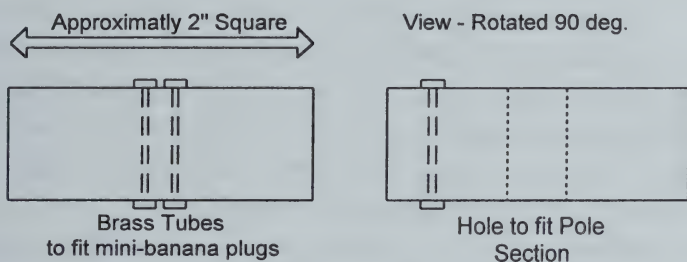
220 and up

Most QRPers would have traditionally asked "Why?" when we discuss these bands. But the FT-817 changed all

that. We now have a super portable rig that has both 2 meters and 70 cm. This makes the 10-meter mast a real useful tool for portable VHF small signal work. All the same concepts that were discussed on 2 meters can also be used on these frequencies. When at Dayton the year the DK9SQ was introduced, the folks at the booth also had a neat dual band (2m/70cm) log periodic antenna that folded up into a very small, transportable package.

Special Fixtures for Experimentation

I mentioned earlier the special fixtures made from small wooden blocks that allow flexible experimentation. Below is a drawing of one.



1. Custom Blocks, cut from available wood (2x4 works nice)
2. Use Table saw to make square and appx. 3/4" thick
3. Drill center hole to sit on top of target section of 10M pole
4. Use small brass tubing to make jacks for mini-banana plugs
5. Drill holes to use as spreader in each side for 1/4" fiberglass rod.

Figure 8

Summary

You probably were not prepared to start at 160 meters and go all the way to 70 cm. Most of us have specific operating habits. We may prefer to operate 40 meter CW, 20 meter SSB, 10 meters, etc. We may not have much need for more than a few bands on any particular outing. But when you become aware of the possibilities, you realize that the 10 meter mast is much more than a support for a simple vertical. It can become a central component in a system that provides options for any operating need. Furthermore, with some thought and engineering, you can package a multi-band capable system in a package not significantly bigger than the mast alone. The key is to have reusable elements that can be configured for more than one use.

This has been a work-in-progress for me. It is far from over. It's easy to create antennas that use trees or towers to erect. I prefer to have solutions that do not sacrifice performance but allow light, portable options for the traveling operator. If you *can* take it with you, you are more apt to *actually* take it. That's when the fun really starts. In that vain, I have packed my FT-817 into a portable case that is always ready to go. When the whole station, mic/key to antenna can be grabbed on the fly and one knows everything is in there, you don't even have to think about it. You just do it.

There are a number of further developments that I continue to work on. One is to model the various designs to validate and document the actual patterns. To that end, I'm slowly learning EZNEC. As that work is completed, EZNEC models will be added to this paper. A second project is to develop a comprehensive table that lists all the lengths and values I have found in my experimentation. A final portion of the project is the most ambitious part. A good friend (AG5RS, Ron Sparks) has a farm to the West of Houston. There we have room to actually erect an HF antenna range designed to measure field strength at various heights to validate actual take-off angles. This will require RF sensors mounted on a

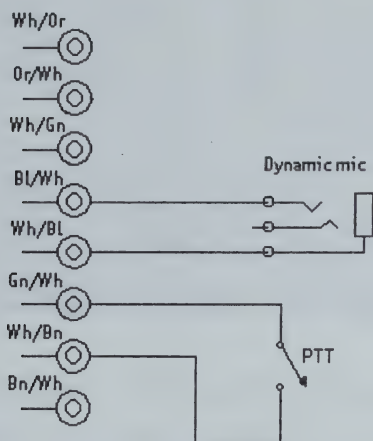
tall tower. Don't expect these results in the near future.

I am always interested in your ideas on this subject. I am certainly not the expert here. I am only sharing my ideas and thoughts. Let's hear yours.

Ed Manuel, N5EM, n5em@amsat.org

Interfacing an external headset to the FT817 by Graham F Firth G3MFJ/W3MFJ

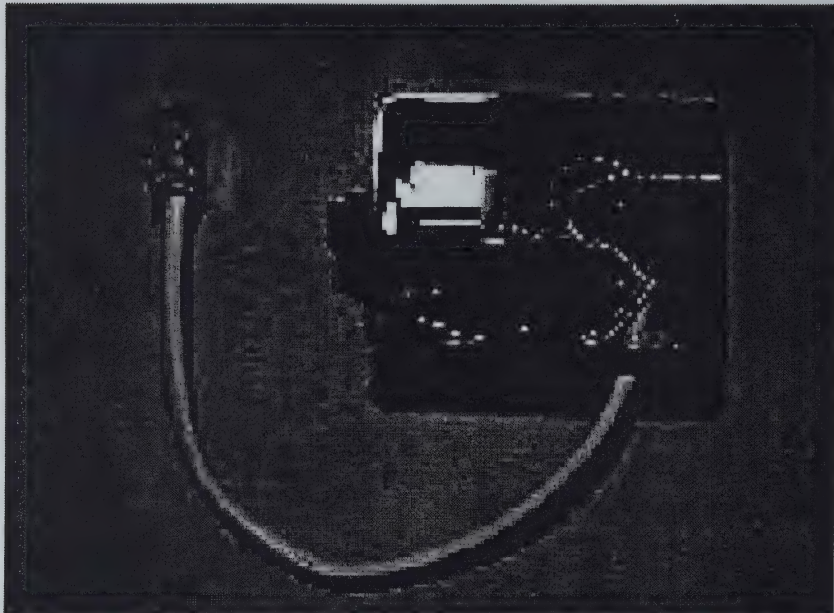
During a series of e-mail discussions with Jay (W5JAY), we discussed external microphones/headsets, and their connection to the FT817. He said that he had obtained a couple of combination headsets (with boom microphone) from Radio Shack & he sent me one.



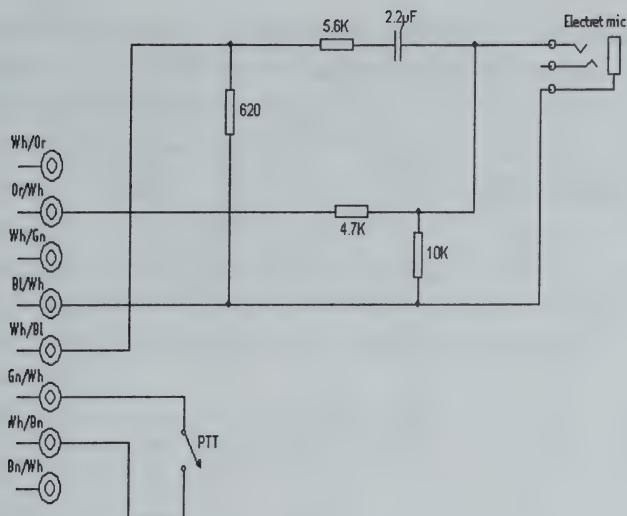
I looked at the possibilities of connecting this to my FT817. The FT817 has a stereo 1/8" (3.5mm) jack on the side for a headset and as the Radio Shack headset came with the appropriate plug, that solved half the problem.

However, the microphone socket is an RJ45 crimped type plug and I wondered how I would find a plug for this until

I realised that the 10base4 computer networking plugs were ideal. Tony (G4WIF) gave me a double-ended lead, so I had my plug - 2 in fact! The colours shown in the diagram are mine - yours may vary, but every one I have checked seems to be the same. Looking into the mike socket of the FT817, the brown/white connection is the bottom left.



This first interface was built in a small box with a locking push button for PTT (press to talk), and the circuit is very simple

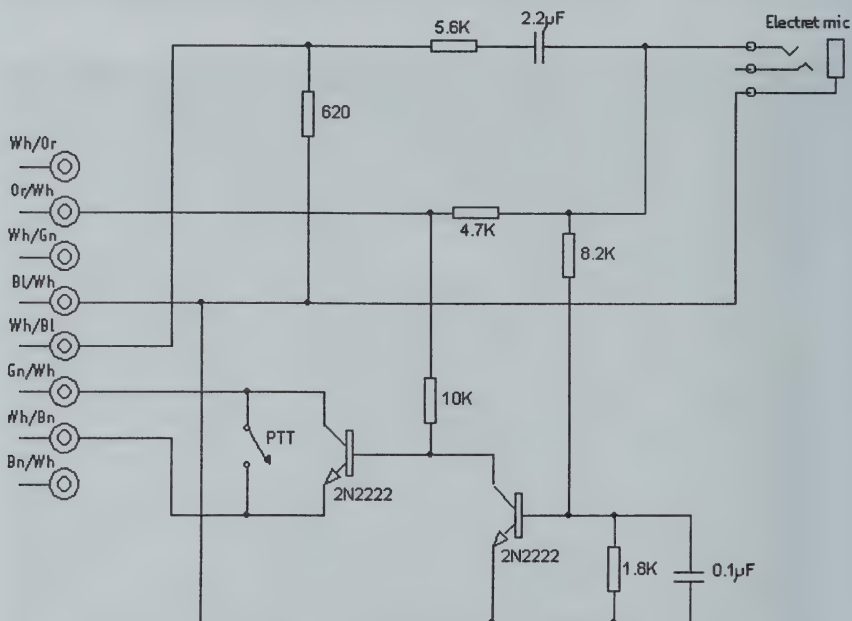


This got me thinking. I also had an electret microphone and I wondered if this would work with the FT817. Further studies revealed that the white/green lead had the main supply voltage on it (9.6 to 13.6 volts) which was available to provide the polarising voltage for this microphone (via the 4.7k resistor). The output of an electret capsule is higher than a dynamic microphone, so I needed a little attenuation. This is given by the 5.6k and the 620ohm resistors. The capacitor is to isolate the polarising voltage from the 817 microphone input.

Out came another small plastic box, and this became a practical proposition. Good job I had two RJ45 plugs and leads!



Flushed with success with this venture, I then wondered if the external speaker/mike for my little Icom handy would work with the 817. I took the Icom mike (MH75) apart to study its circuit & saw that the PTT button was in series with the electret capsule.

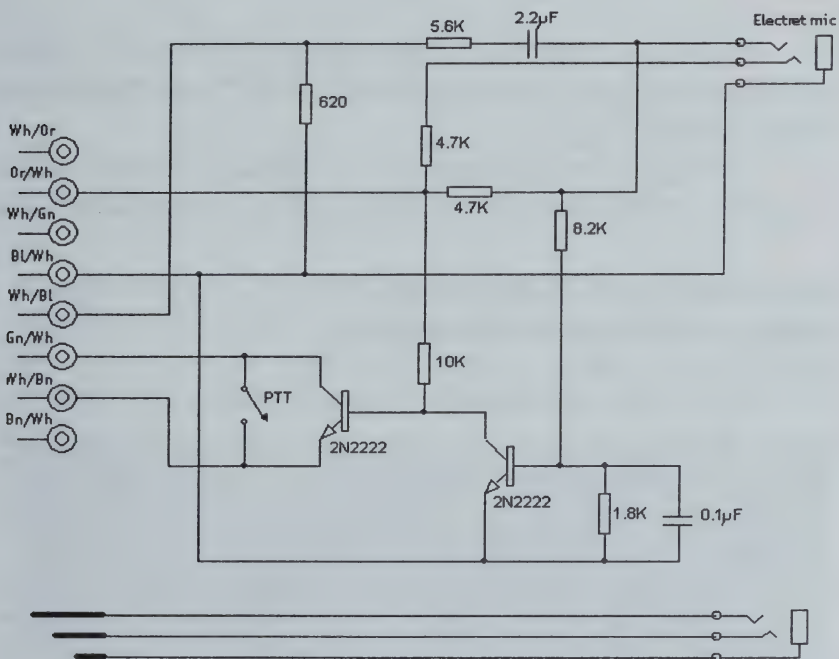


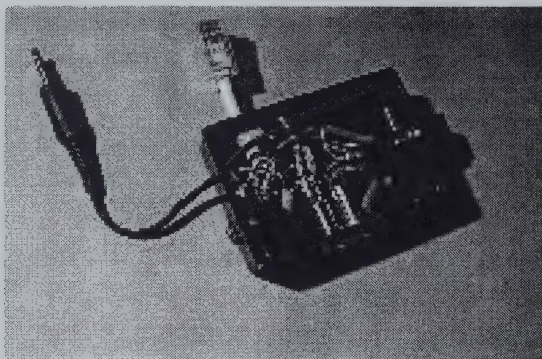
When I connected this to the circuit above, there was a voltage change at the junction of the 4.7k and the 10k resistors due to the load of the electret capsule. Ah, I thought, if I can detect that change, I could use it to switch a transistor on & thus put the 817 on to transmit. A few components later, I had this circuit.

I split the 10k resistor & put a 2N2222 base/ emitter junction across the lower part with a 10k collector load, and put a second 2N2222 to detect when this transistor was off, and then used this to energise the PTT. (The Wh/Bn and Bl/ Wh leads are both chassis/0v).

I actually used UK equivalents of the 2N2222 - a BC547, but any general purpose NPN will do.

Next, I thought what about the speaker part of the speaker/mike - that was easy. The MH75 has a moulded double mini-jack with the 3.5mm plug as the mike, and the 2.5mm plug as the speaker. There is also an LED in the speaker/mike - no real function - but it looks good!





So I duplicated the 817 headphone socket on my little interface box at the requisite distance ($\frac{1}{2}$ ") from the electret mike socket.

This gave me this final circuit. The 4.7k resistor to the ring of the mike socket will light the LED on the speaker/mike

Interfacing PSK31 to the FT817

By Graham F Firth G3MFJ/W3MFJ

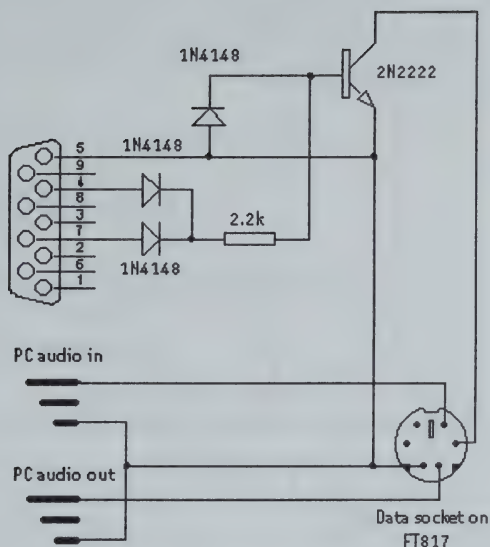
The FT817 is a very easy rig to use for PSK31. All you need, besides a suitable PC of course, is the appropriate plugs, a suitable transistor, and a few "junk box" components. The PC must have a sound card fitted of course, as this is the way the audio gets into and out of the PC.

Much of what I say here will apply to many other SSB transceivers, all that is required of them, is a suitable audio input (you can use the mike input if necessary), and an audio output (the phones socket will do).

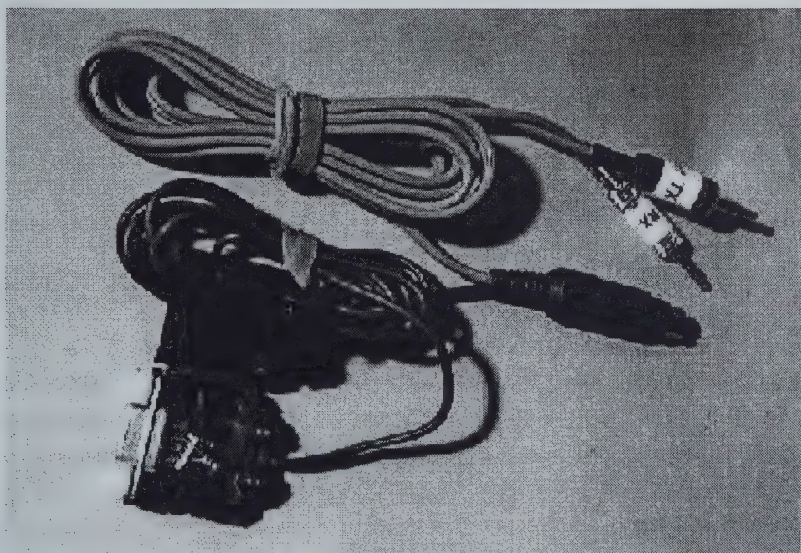
Here is the circuit diagram of the simplest version of the interface.

As you can see, there is nothing to it! I have shown a 2N2222, but any NPN transistor that is suitable to operate the TX/RX relay (350mA in the case of the FT817) will do. I used a BC547 which is a UK equivalent.

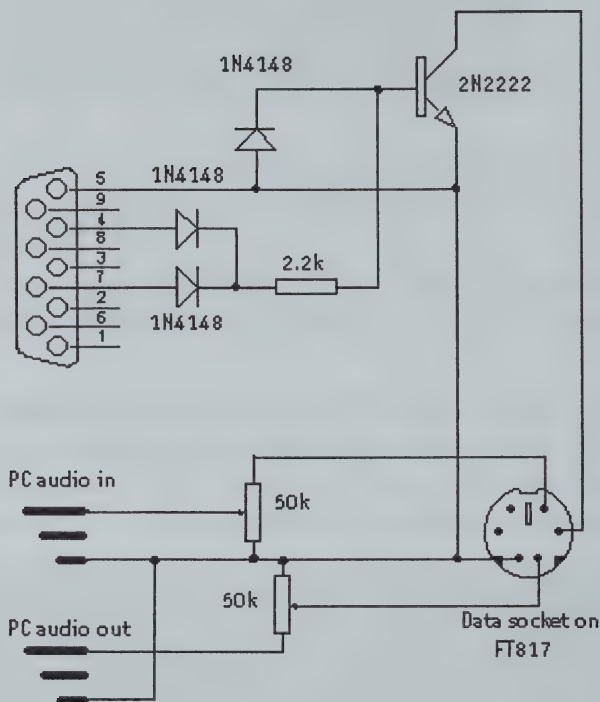
All PSK31 software that I have found will lift either the DTR (pin 4), or the RTS (pin 7), of the appropriate COM port of the PC to +ve on transmit. This will turn the transistor on, thus putting



the rig to transmit. I built the transistor circuit into a 9 pin D plug. The audio connections assume that the output level matches the input level both ways. In my case this is fine as my PC has a line level input as well as a microphone input. If you have to use



the microphone input of the PC, or the microphone input of the transceiver, then you will probably need some attenuation in one or both directions. Here is the above circuit with some variable attenuation in both directions.



I used 50k presets because that is what I had to hand, but any value 5 to 50 k will do.

Now the software. There is lots of this available on the internet some of it freeware, some shareware, and some you have to buy. Here is a list of the software I found recently:

WinPSK223e

<http://www.imiwebs.com/winpskse/>

WinWarbler

<http://www.qsl.net/winwarbler/download.htm>

Psk31sbw

<http://www.qsl.net/wm2u/psk31.html>

W1SQLpsk

<http://www.w1sql.com/download.htm>

Zakanaka

<http://www.qsl.net/kc4elo/>

Digipan

<http://members.home.com/hteller/digipan/>

WinPSK21

<http://www.qsl.net/ae4jy/>

The above interface will work with all the above software, when it is loaded on your PC, you will need to customise it by inserting your own call, location & station. The only other thing will be to get the levels right. Firstly, I set the appropriate option by selecting PSK-U on menu 26. Secondly, I adjust the audio input so that the green noise is just showing (you'll see what I mean when you do it! Finally, I set the audio input volume to the transmitter whilst watching the ALC level and setting it to half-way. Very unscientific I know, but it works for me! That's it! Enjoy some PSK31

Gel-Cell Charger 700 mA Max - 2001 version

By Bill Hickox, K5BDZ

k5bdz@aol.com

[Originally printed in the Peanut Whistle, St. Louis QRP Society. Reprinted with permission]

The 2001 design version of the Gel-Cell Charger is first and foremost a "battery charger" for gel-cells and small lead acid type batteries. It is not recommended for any other battery types. This gel-cell charger includes monitoring for Heavy Charge-Current Limiting, Normal Charging and Float functions. Best of all, it uses easy to find junk

box parts and is simple to build!

This circuit has some significant differences (and improvements) in concept and operation over my previous designs. It's more "user friendly" and "goof proof". All control functions are now in the positive line and the negative circuit throughout is at ground potential. This allows multiple connections, uses, etc. without damaging charger parts. The explanations will show how the individual circuits are applicable to other doo-dads too. I've built mine into a portable AC/DC power supply box. It will "automatically" cut over to Battery DC in the event AC is lost, yet will not allow the operating AC supply to connect to or harm the battery and charger.

A 73 Magazine charger article from several years ago had some of the same design aspects. Those recognizing the similarities will be correct. However, a comparison of the two circuits is both interesting and informative. I trust this design will prove to be the preferred circuit to all builders.

Theory of Operation:

The basic charger, without monitoring circuits, is a simple, regulated voltage power supply. AC voltage in should be at least 12 VAC (bringing 16.8 volts DC to the output of the bridge circuit rectifier) and no more than 16 VAC. Voltage control is determined by the 2 x 470 W resistors, VR1 (coarse adjustment) and VR2 (fine adjustment). Heat sinking of the 7805 is essential!

Charge Monitor Circuit:

This circuit is made up of D5, D6, 4.3W resistor, 150W resistor, Q1, Q4, Q5, yellow LED and Q3. As the charger current exceeds roughly 100 mA, the resistance of the 4.3W resistor is greater than the two series diodes D5 and D6, turning on these diodes. Q1 (PNP) is connected to turn on when the ~ 1.2 volt voltage drop via D5 and D6 happens. Q1 then turns on Q4. Q4 shorts to ground the two circuits fed by

the 10K resistor, i.e. the Q2 Green LED (Float) as well as shorting VR2. Shorting VR2 lowers the ground resistance to the U1 regulator common pin, thus raising the charger voltage to overcome the ~ 1.2 volt drop through D5 and D6 and maintain the correct charge voltage.

Maximum Charge Current Circuit:

This circuit is made up of the two parallel 2.7 W resistors, VR3, Q6 and the red LED. When over-current or maximum current through the two 2.7 W resistors and VR3 is detected, Q6 completes the LED circuit, turning it on. The LED is connected to the circuit before D5 and D6 to provide the necessary 1.2 volt differential, minus Q6 voltage drop, equaling » .6 or .7 volts necessary to turn on the LED. VR3 is adjusted to turn on at the maximum charger current the builder requires, but not to exceed 800 mA output with the component values indicated here.

Float Monitor Circuit:

This simple circuit is Q2, Green LED and associated resistors. The circuit is turned on as long as the charger is providing voltage, except when turned off by Q1 during heavy charging periods in excess of approximately 100 mA. "Float" charging basically tells you that the proper voltage is present for the gel-cell battery to "use what it wants whenever it wants" to stay charged. D7 protects the overall circuit from improper reverse battery connections. D7 also keeps the battery from lighting the green LED from when the battery charger is turned off (prevents "false" indications).

Uninterruptable Power Supply connections:

Most "12 volt" power supplies deliver 13.8 volts. For typical amateur rigs, this voltage should not be exceeded. Assuming you have a supply delivering 13.8 volts, connect the supply to the output ports of the charger as shown.

If this is your connection preference, the charging volt-

age to the battery should be set to 13.6 volts. With the D8 causing a circuit voltage drop of .2 volts or less (depending on type diode used) the higher 13.8 volts from the main power supply will effectively “turn off”, i.e. reverse bias D8 when in use. In the event of main power failure and the 13.8 volt supply is lost, D5 is immediately turned on connecting the battery with no loss of power to the rig. D8 must be a heavy-stud germanium, schottky barrier or similar diode type. Remember, D5 should exceed the current rating of your needs (1 Amp minimum!).

Charger adjustments and voltage settings:

Refer to Schematic Drawing page. Please note when performing voltage checks beginning at U1 and continuing at various points to the battery output, allow for higher voltage at U1 output due to the resulting voltage drops caused by the in-series D5, D6, and D7 as the circuit flows to the battery.

Final comments:

For “battery charger only” usage, and with no power supply connections to the output, the maximum preferred battery charging voltage is 13.8 volts. D8 is still recommended for circuit protection, especially if the builder uses binding posts for “universal” power output battery connections. Hope you now understand each separate circuit and can use them in many of your future homebrew projects. Have fun with your building!! **K5BDZ -30-**

QRPing with the TunaTin 2 and the SMK-1 by Robert Chapman, W9JOP/4

I was first licensed in 1954, while stationed in Scotland with the USAF, and of course unable to operate there, since no agreements. Finally became active in 1956, from California, running a Heathkit AT-1, VFO-1 and AC-1 coupler, vertical, made of beer cans. (scrounged from the dump). Big radiating surface!. (40 mtr CW). Had my share of ARC-5 equipment, which was plentiful , still being in the USAF. This equipment of course ran pretty low power, depending on what parts you could scrounge for the power supply. Had a young family at that time, and about \$12-15 bucks weekly budgeted for food., thus the emphasis on scrounging. Built a 2EL 15mtr beam, made of bamboo poles wrapped in Reynolds wrap. Birds pecked the wrap.



Bob sitting at the operators position of his shack.

Time passed and we left the service. Power now up to 100 Watts. Played with DX, and RS-12 . Second attempt at the 2 EL, 15mtr beam from bamboo poles, covered with Reynolds FREEZER wrap, so no more bird problem.

Sold the station in 1995, saved one Receiver and moved to W9JOP/4. Cooped up in a small, home, no ant space. Did a stealth job and fastened a 15 mtr dipole to inside of wooden fence. SWL, SWL. Then read about the Tuna Tin 2. Gonna build that for a fun project, (not knowing what excitement lay ahead of me).

I still have the welts on my arms where the ole QRPp[Bug got me! My Tuna Tin went together just fine, and was looking good into a dummy load.

Time out , from thinking radio, (for 14 months, while Son and I built our new home). Yes, we put it right in the middle of a grove of antennas, oops, I mean trees.! Never saw so much dry-wall , wiring, plumbing, etc in my life . XYL, Joy , KA9TTB was my Big helper, through-out. Finally arrived at age 66.

Put a G5RV up at 50ft, with mother natures help. MFJ tuner to keep the TT2 happy. First year was spent crystal controlled on 7043 kcs. A keying ckt was incorporated into the Tuna Tin, giving my wrist a long needed vacation from an old J-38, (liberated from the USAF.)

Now after a year and 709 QSOs later it was time to QSY! In comes the SMK-1. Read about it, sent for, and built it. My, My, what small parts! First contact with SMK-1 came on Feb 28, with Larry, W8CCY, of MI. We're in hog heaven, having the capability of two freqs. Wanna QSY?, buy another rig! (The SMK-1, is a 40 mtr Xcvr, Surface Mount Kit, that WAS offered by NORCAL at that time. Their purpose, being to introduce the Ham community to the art of surface mount construction .)) WILL HAVE TO SAY IT WAS AN INTERESTING BUILDING PROJECT! Let's prod NORCAL into something new!!

At present, our paper log shows 1352 QRPp contacts. Have worked/confirmed 48 States, as recognized by QRPARC W.A.S., cert # 486, (48 States, all QRPp 250mw or less). Lack KL7 And KH6.

The SMK-1 has 48 States and 6 DX (Eur) stns to its

credit. TT2, coming in at a close second, with 46 States and 3 DX Stns.

Just finished building another TT2, (from the schematic of the first), layed out to look like the schematic. Also incorporated the keying transistor 2N3906, to facilitate using the Tick Kyr. Seems to be doing alright, except for the Digital QRM so close to 14060 kcs.

This is my story, and I have been invited, by Doug , KI6DS, to share it with you. Just a reminder that THERE IS LIFE BELOW 1 watt! Want to thank all the Fellow Hams who did their best to pull me through. TKS FELLOWS.

We have no QRO rig in the house, just three QRPp rigs. However, I am cheating just a little bit! (Using a 51S1 for my hearing aid, with the TT2), and under hvy QRM, condx , with the SMK-1.

Am now hanging-out on 14060, trying to hold my own. Just reached 69 yrs, still ditting!

72 es TKS

Bob W9JOP/4 QRPp Stn pix on QRZ.COM

Wilderness Sierra SWR Indicator

By Kory Hamzeh, AC6RN

Circuit Description

Right off the bat, I need to say that this circuit was adapted from the article entitled ScQRPion Visual SWR Indicator by Dan Tayloe N7VE in the Spring 97 issue of QRPp. Instead of using the LED to indicate SWR, I removed the LED and added a diode detector and a voltage divider.

This schematic is a relative SWR indicator. I say "relative" here because it does not indicate the true SWR value, but can tell you how close you are to a perfect 50 ohms match. It is designed to work with the Wilderness KC2 Keyer/Wattmeter. If you do not have a KC2 installed in your Sierra, you

can use the original circuit by N7VE.

LED D1 is totally optional. It is one of those self contained blinking LEDs that I plan to put on the front panel to let me know what the SWR bridge is “spliced” in. If you decide to use a standard LED, make sure you include a current limiting resistor!

R1, R2, and R3 and 50 ohm 2 watts carbon (non-inductive) resistors. Keep these resistors as close to 50 ohms as possible or the accuracy of the bridge may suffer.

T1 is a FT37-43 ferrite core. The primary is 12 turns and the secondary is 36 turns on #28 enamel wire.

Hookup and Installation

The “RF” port is the current location that the KC-2 taps for RF power. It is the output from the RF power detector on the main Sierra board.

The “RF Meter” port is pin 13 on the KC2.

The “Antenna” and “PA Out” ports need to be spliced in right before the antenna BNC connector. This requires that you cut a trace on the circuit board.

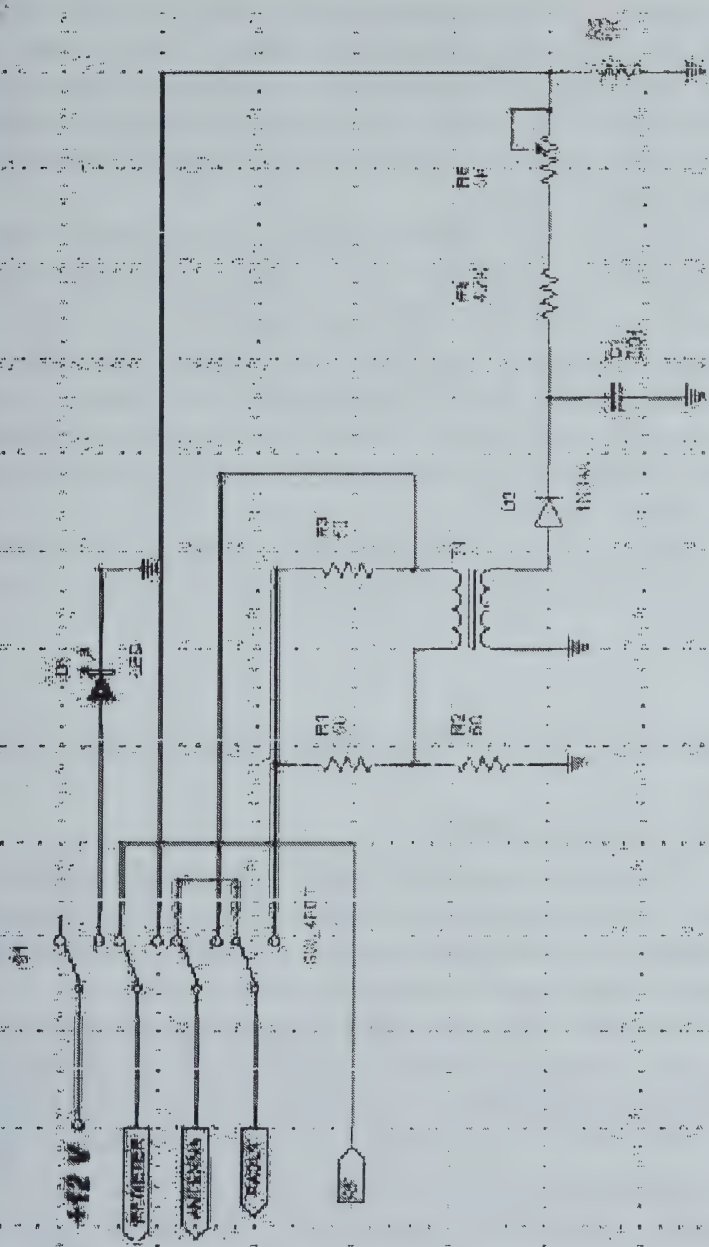
Install the circuit board as close to the antenna connector as possible. Use shielded coax cable such as RG-174 (must be 50 ohms).

Calibration

To calibrate this circuit, switch SW1 to the ON position, disconnect your antenna, and press “SPD +” and “SPD -” simultaneously. Now, adjust R5 to get a “9.8” reading on the KC2. Don’t worry, this circuit will never let the SWR exceed 2:1, however, don’t leave it in this state for too long either, the finals may over heat. Now, hook up a 50 dummy load, and it should read close to 0.0. If it’s way off, then you did something wrong.

Normal Operation

When S1 is in the OFF position (as in the diagram above), this circuit is bypassed. Pressing “SPD +” and “SPD



-” on the KC2 will operate as before. With S1 on the ON position, the circuit will get spliced in. When “SPD +” and “SPD -” is pressed, the KC2 will display a relative number describing how close you are to a 50 ohm load. You want to adjust your tuner to get the lower reading. A value of 0.0 indicates a perfect 50 ohm match.

This circuit is an “SWR Absorbing” type bridge. The circuit will not allow the SWR to ever exceed 2:1 during tune up. This is very important for QRP rigs that do not have high SWR protection circuitry. The down side of this on this type of a circuit is that you can not operate with the bridge in line because of the 6 dB insertion loss. That’s the reason I decide to include a blinking LED on the front panel to let me know that the bridge is inline.

Anyway, try it out and have fun. Let me know how things go! I can be reach at kory@avatar.com. Good luck de Kory AC6RN.

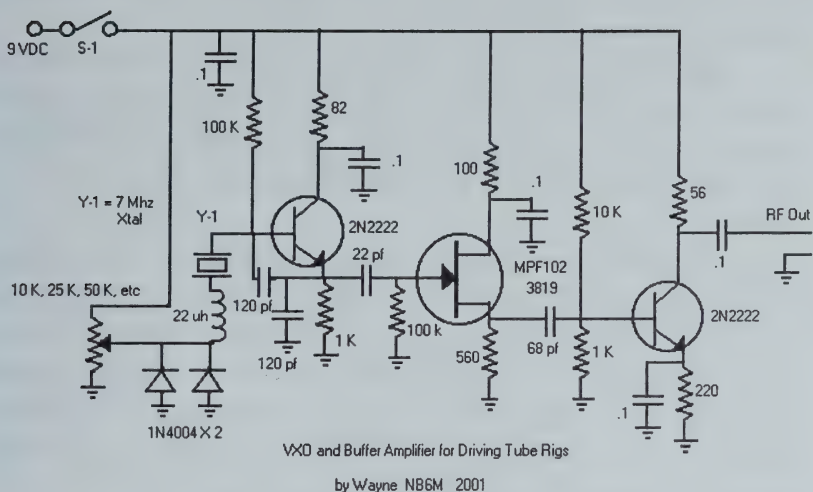
VXO and Buffer Amplifier, For driving Tube Rigs

By Wayne McFee, NB6M

The accompanying VXO and buffer circuit details should provide anyone who has a small parts bin with a very useful accessory which will allow the use of smaller, modern crystal types to control and provide drive for tube rigs.

I use this VXO and buffer to drive my old Heathkit DX-40, and it provides stable operation over about a 4.4 Khz segment of the 40 Meter band, from 7037.5 to 7041.9 Khz.

You could try paralleling the crystal with another one of the same frequency, and perhaps double the frequency swing. However, in tests I have made with parallel crystals in this circuit, the frequency jumps around at places in the tuning range, and I have elected to stay with the smaller tuning range of one crystal. You are welcome to experiment.



The complete circuit, including the 9 Volt battery used to power it, can be very easily built into an Altoids tin. Any of a number of transistor types could be substituted. For the bipolars, either 2N2222, 2N3904, 2N4401, or similar NPNs could be used. For the FET, MPF102, 2N3819, J310, 2N4416, or similar could be used. If you don't have the exact resistance or capacitance specified, try something close. For the bypass capacitors, anything from .01s to .33s would work fine.

This circuit may work just fine on other bands with no changes. If need be, the feedback capacitors in the oscillator circuit could be changed. If you try an 80 Meter crystal and the oscillator doesn't perform properly, doubling the capacitance to 240 or 270 pF would probably work. For higher bands, the capacitance could be scaled accordingly, by sim-

ply figuring the X_c of the 120 pfs on 40, and using a capacitance value that would give close to that same amount of reactance on the band of choice.

As the circuit is drawn, it is necessary to switch the circuit off, using S-1, during periods of reception, and then switch it back on before transmitting. A simple electronically switched keying circuit or offset circuit could be built in, if desired.

In order to spot the operating frequency in the receiver, within the tuning range of the oscillator, first tune the receiver to the clear frequency or the frequency of a station calling, switch the circuit on, tune the VXO, and then, if transmission is not planned immediately, turn the circuit off. If transmission is planned immediately, the circuit is left on, and then turned off to quiet the oscillator during receive.

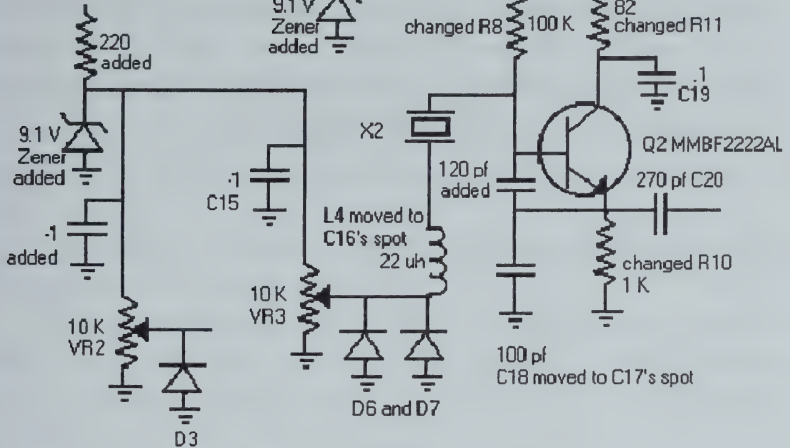
Enjoy. Wayne NB6M

Extend the SMK-1's TX tuning range, And clean up the TX note

By Wayne McFee, NB6M

Never having been satisfied with the very limited tuning range of the SMK-1's transmitter, and wanting to clean up the transmitted signal's keying note a bit at the same time, I decided to change the oscillator circuit in the transmitter to a different configuration which would allow the stock tuning elements to provide for about a 4.5 KHz tuning range, and provide for voltage regulation of the supply for the TX oscillator itself and both the TX and RX tuning pots.

This involved moving some of the existing parts in the oscillator circuit to other locations, cutting a few traces to accommodate the new configuration, and adding a few parts. The result, to me, is more than worth the effort involved. After modification, the tuning range of the transmitter, from zero



Modified 5MK-1 Transmitter Oscillator for extended tuning range and better stability.

Now, the tuning range of the transmitter equals and nearly matches the tuning range of the receiver, and makes the little rig that much more useful in terms of dodging QRM and finding a clear frequency for a CQ, or answering other calls.

Reducing the voltage applied to the receiver's tuning pot has not reduced its tuning range, and now the receiver's LO does not drop out of oscillation at the high end of the tuning range. As modified, the receiver's tuning range, from zero beat to zero beat, is from 7036.3 to 7040.9 Khz, only one tenth of a Khz different than the transmitter. In addition, since the receiver's LO frequency is more stable during keying of the transmitter, there is no false indication of instability in the transmitter.

Here is the schematic of the "Mod", including the changes to the TX oscillator circuit and the added voltage regulation both for the TX oscillator and the tuning pots for the receiver and transmitter.

Two, low-wattage soldering irons are a must for this project. Solder wick will also be needed, and thin solder with silver content is recommended. In order to modify the transmitter's oscillator circuit to this configuration, it is first necessary to remove the following parts:

R8
R9
R10
R11
C16
C17

Have a moistened cloth pad ready to wipe the removed part off of whichever soldering iron it sticks to. You may want to tape the parts to a sheet of paper, labeling them as you do so, as they may well be usable for another project.

Clean the pads for C16 and C17 with solder wick, move L4 to C16's spot and move C18 to C17's spot.

You will need the following new parts to add to the circuit:

- 2 9.1 Volt Zener diodes, added
- 2 220 Ohm, 1/4 w resistors, added
- 1 100 K Ohm, 1/4 w resistor, to replace R8
- 1 82 Ohm, 1/4 w resistor, to replace R11
- 1 1 K Ohm, 1/4 w resistor, to replace R10
- 1 120 pf NP0 capacitor, added
- 1 .1 uf bypass capacitor, added from top of VR2 to ground

In the following descriptions of solder pad locations, the

three 10 K Ohm pots are the front of the board, the wire connections are the rear.

In order to accommodate the changed oscillator configuration, cut these traces:

The 12 volt trace between the printed copyright C and C15.

The 12 volt trace between where it branches off from the one just cut above and VR2. Cut this trace close to the nearest leg of VR2, so that the main trace is still good to VR3.

The trace between the rear pad for the removed R9 and X2, right at the R9 lettering.

The trace between X2 and C20, between the junction of the trace that goes to L4's pad and C20. We want the trace to still connect from X2 to L4's pad, but not to C20 or the collector of Q2.

Move C18 so that it connects between the rear pad for C18 and the left pad (closest to Q2) for C17. This is necessary because the output of the oscillator is now taken from the emitter instead of the collector.

Add the 120 pf NP0 cap between the base of Q2 and the left pad (closest to Q2) for R10. The base of Q2 is the contact of Q2 closest to X2, on the side of the transistor that has two contacts. This capacitor, along with the 100 pf cap that was moved from C18's spot to C17's old spot, provide the feedback necessary for Q2 to oscillate.

Solder the 1 K Ohm resistor in R10's location, with the leads cut as short as possible.

Solder a short piece of insulated hookup wire from the rear pad for R9 and the right pad for L4 (the L4 pad closest to the edge of the board). This connects X2 in series with the 22 uh choke that is now in C16's old spot.

Cut the anode leads for the Zener diodes, one lead for the .1 uf capacitor and one lead of each of the remaining resistors to about 3/16" length.

Solder the anode lead of one 9.1 volt Zener diode to the front pad for C19 (ground).

Solder the short lead of the 82 Ohm resistor to the front pad for R11.

Solder the short lead of one 220 Ohm resistor to the rear pad for R11.

Solder the short lead of the 100 K Ohm resistor to the front pad for R8.

Bring the loose leads of that Zener diode, the 220 Ohm resistor, the 82 Ohm resistor, and the 100 K Ohm resistor together, to form a junction as close to the bodies of the parts as is practical. Cut the free leads of all four parts so that there is just enough length for a good solder joint between the four. Solder the leads together.

In my rig, the four parts just described lean over towards U3, leaving a low profile of parts, but also leaving enough room between the soldered joint between the four parts and the circuit board so as to ensure that there are no shorts.

Solder a short piece of insulated hookup wire between the front pad for R11 (where the 82 Ohm resistor is attached), and the front pad for C20 (now unoccupied). This supplies operating voltage from the 82 Ohm resistor to the collector of Q2.

Solder the short lead of the .1 uf capacitor to the front pad of C15 (ground). The other lead, left long for the moment, is soldered, close to the capacitor's body, to the nearest leg of VR2, leaving the remainder of the long lead free.

Solder the short, anode lead of the remaining 9.1 Volt Zener diode to the front pad of C15 (ground). The cathode lead attaches to the junction of the nearest leg of VR2 and the .1 cap just attached there. Bend the free leg of the capacitor out at a 90 degree angle from the leg of VR2 and cut the cathode lead of the 9.1 Zener so that it just overlaps the lead of the capacitor. Trim the capacitor lead.

The short lead of the remaining 220 Ohm resistor connects to the junction of the cathode of the 9.1 Volt Zener di-

ode and .1 cap just installed. Position the short lead of the 220 Ohm resistor at that junction and solder it in place.

Now, in order to supply 12 volts to the regulating circuit for the two tuning pots, the remaining lead of the 220 Ohm resistor must be connected to an "always on" 12 Volt source. In my rig, I ran it to pin 8 of U3 and soldered it there.

You will need to be sure the bare lead is not close enough to any other contact to short out, and cut it so that it is just long enough to form a good solder joint on top of pin 8 of U3.

If you do the same, just use a small amount of solder and check carefully for a solder bridge from pin 8 to pin 7 of U3 before applying power. If you are concerned about attaching the lead there, you can run it to any other 12 volt trace on the circuit board, or even to the power jack's center connector, if you like.

Solder a short piece of insulated hookup wire between the rear pad of C15 and the junction of the cathode of the 9.1 volt Zener, .1 uf capacitor, and 220 Ohm resistor at the near leg of VR2. This supplies 9 Volts regulated to the transmitter's tuning pot.

That completes the mod. Check your connections, again, especially checking between pins 8 and 7 of U3 for any solder bridges.

In my modified 40 Meter SMK-1, it was necessary to solder a short piece of cut off resistor lead across R14 in the PA circuit, so as to increase the output slightly, as the lower voltage output of the oscillator in this configuration meant that the output from the PA was below the threshold of drive necessary for the IRF510 in the 5 Watt Mod I had added. Bypassing R14 increased the available drive from 3.3 Volts RMS to 4.5 Volts RMS on the gate of the Mosfet, which was sufficient to produce 5 Watts of output.

You may need to bypass R14 as well, if you do this VXO Mod, so that your power output level will be what it was with the higher drive of the original oscillator configuration. I would suggest starting with a 2.2 Ohm or slightly higher value resis-

tor in place of R14, so as to help ensure that there are no overheating problems with Q3.

Although this mod sounds a little complicated when it is described on paper, it took far less time to actually do the mod than it did to write it up. I completed the mod from start to finish in about an hour and a half, even with having to remove the 5 Watt Mod parts to get to the board itself, and then replace them after the mod was done. The results are well worth the effort.

In addition, this oscillator configuration can be used in any of the Tuna Tin II type transmitter circuits, with similar results.

I would welcome any input as to improvements on this "Mod" or any of the others I have developed, as I am sure everyone else who enjoys either the SMK-1 or any Tuna Tin II based transmitter would as well. Please share your results and/or suggestions on QRP-L and to myself via email.

Enjoy. Wayne NB6M

A Short Guide to Harmonic Filters for QRP Transmitter Output.

A Complete Do-It-Yourself Kit with just a few simple calculations

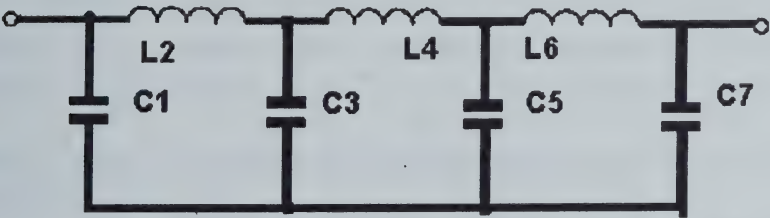
Rev. George Dobbs G3RJV

Although by their very nature, QRP transmitters radiate less power, the output from such a transmitter does require adequate filtering. Usually to keep the circuit compact, these transmitters have a final stage run in Class C and being driven hard with RF power. Of itself, this is a recipe for high harmonic output and a well designed low pass filter is essential. For many years I have used low pass filters calculated from a series of figures produced by Ed Wetherhold, W3NQN, (*a G QRP Club member*) and published in two articles in the UK Short Wave Magazine in December 1983 and January 1984.

Ed Wetherhold has been the ARRL adviser on passive filters for several years and published many fine articles on audio and radio frequency passive filtering. I believe that the two articles in Short Wave Magazine still represent the best source of information for the design of good low pass filters for RF amplifiers.

The articles are comprehensive but here I just want to share enough of the information to enable readers to build useful filters to add to their home made transmitters. There is very little mathematics - about 4 pushes of a calculator is the most required to produce information for a buildable filter. I will also give a chart for “off the shelf” low pass filters, which can handle up to 10 watts or RF power, suitable for every HF amateur band.

The W3NQN designs are based upon a seven elements: four capacitors and three inductors. They are designed for 50 ohms input and output impedance and use standard capacitor values. This is very useful because many calculations and computer programs for filter design give very odd values of capacitance which have to be made up from series and parallel values. Figure 1 shows a Seven Element Low Pass Filter. Now lets look at some numbers.



Recommended Values

Table 1 is a very short extract from a large list of filter parameters in the original W3NQN articles. I have taken the practical values for the nine HF amateur bands which have given me the best results over the years. Alongside each band are values for the seven elements in the filters with values on pF for capacitors and uH for inductors. The characteristics of each filter are described in terms of the ripple cut-off frequency (F-co) and the frequencies of the 3dB (F - 3dB) and 30dB (F - 30dB) attenuation levels. The capacitors are all easy values. I generally use polystyrene capacitors for my filter building.

W3NQN 7 ELEMENT STANDARD VALUE CAPACITOR LOW PASS FILTERS

TABLE 1 : Recommended Values

| Band | F-co | F - 3dB | F-30dB | C1,7 | C3,5 | L2,6 | L4 |
|---------|-------|---------|--------|------|------|-------|-------|
| MHz | MHz | MHz | MHz | pF | pF | uH | uH |
| 1.8 | 2.16 | 2.76 | 4.0 | 820 | 2200 | 4.442 | 5.608 |
| 3.5 | 4.125 | 5.11 | 7.3 | 470 | 1200 | 2.434 | 3.012 |
| 7.0 | 7.36 | 9.04 | 12.9 | 270 | 680 | 1.380 | 1.698 |
| 10.1 | 10.37 | 11.62 | 15.8 | 270 | 560 | 1.090 | 1.257 |
| 14.0 | 14.40 | 16.41 | 22.5 | 180 | 390 | .773 | .904 |
| 18.068 | 18.93 | 22.89 | 32.3 | 110 | 270 | .548 | .668 |
| 21.0 | 21.55 | 27.62 | 39.9 | 82 | 220 | .444 | .561 |
| 24.98 | 25.24 | 28.94 | 39.8 | 100 | 220 | .438 | .515 |
| 28 - 30 | 31.66 | 40.52 | 58.5 | 56 | 150 | .303 | .382 |

The Inductors

The inductors are all wound on toroidal cores in the popular Micrometals range. Translating the inductance value to practical inductors is very simple. The formula is given to calculate the number of turns. It does require knowledge of the inductance at 10 turns for the required core. These values are given in Table 2. Again I have reduced the W3NQN information to the 2 mix and 6 mix toroids, the ones that are of most use for this application. The formula is easily executed with a pocket calculator and the resultant figure is rounded to the nearest complete number of turns. The wire gauge is not critical. Simply use the gauge that will fit well on the core. The target is to wind an even coil on the core to occupy about three-quarters of the available space. If the opposite ends of the winding are too close this will introduce extra capacitance.

Table 2: INDUCTANCE AT 10 TURNS FOR MICROMETALS TOROIDS

| Core Color | | Inductance (uH) at 10 Turns | | | | | |
|------------|--------|-----------------------------|-----|-----|-----|-----|-----------|
| Mix | | Core Size & Prefix | | | | | |
| | | T37 | T44 | T50 | T68 | T80 | Range MHz |
| - 2 | Red | .40 | .52 | .49 | .57 | .55 | 1 - 7 |
| -6 | Yellow | .30 | .42 | .40 | .47 | .45 | 7 + |

Power Levels

Table 3 shows the smallest core that may be used for particular RF power levels. It is interesting because for transmitters of 10 watts or less, T37 cores are suitable, making

Table 3: SMALLEST USABLE TOROIDAL CORE FOR OUTPUT POWERS

| | | Power Level Range (Watts RMS) | | | | |
|------|--------|-------------------------------|-------|-------|--------|---------|
| Core | Color | <10 | 10-25 | 25-50 | 50-100 | 100-200 |
| - 2 | Red | T37 | T44 | T68 | T68 | T80 |
| -6 | Yellow | T37 | T37 | T37 | T44 | T50 |

the filters very compact. Also notice that larger cores are required for the lower frequency bands. This again is an extract from the W3NQN data which used a very conservative maximum AC flux density to determine the minimum core size. So use this table to choose a core suitable for the required power handling of the filter.

Practical Examples

Table 4 gives practical designs for a series of low pass filters over the 9 HF amateur bands for transmitters of 10 watts power output and less. The constructor simply has to read off the values and make up the filters. All of these are filters that I have used to good effect in the past. Should you require filters for use with higher powers, take the information from the tables to choose a suitable core and

TABLE 4 : Practical Examples for Transmitters Under 10 watts RF Output

| Band | C1,7 | C3,5 | L2,6 | L4 | Core | Wire |
|---------|------|------|-------|-------|-------|-------|
| MHz | pF | pF | turns | turns | type | Gauge |
| 1.8 | 820 | 2200 | 30 | 34 | T50-2 | 30 |
| 3.5 | 470 | 1200 | 25 | 27 | T37-2 | 28 |
| 7.0 | 270 | 680 | 19 | 21 | T37-6 | 26 |
| 10.1 | 270 | 560 | 19 | 20 | T37-6 | 26 |
| 14.0 | 180 | 390 | 16 | 17 | T37-6 | 24 |
| 18.068 | 110 | 270 | 13 | 15 | T37-6 | 24 |
| 21.0 | 82 | 220 | 12 | 14 | T37-6 | 24 |
| 24.98 | 100 | 220 | 12 | 13 | T37-6 | 22 |
| 28 - 30 | 56 | 150 | 10 | 11 | T37-6 | 22 |

work out the appropriate number of turns for that core. A complete Do-It-Yourself filter design kit !

I keep a range of low pass filters in the shack, each one mounted in a small tin, for testing purposes. So when playing with transmitter circuits, I have a low pass filter I can put into use for testing the output. The more frugal constructor could use such a set of filters for several transmitters and not build filters into each of them.

Homebrew a 4 - 1 Balun

by Mike Martell, N1HXN

Many modern HF transceivers come fully equipped with built in tuners. While these tuners are great for changing bands, the manufacturers left out a very important accessory; the 4 to 1 balun. With out a balun the transceiver can only feed an antenna which uses coaxial cable. While this may be satisfactory for some operators, this is a real problem for those of us who prefer the super low loss ladder line. The only other alternative is to buy an external tuner with a built-in balun which is really absurd after spending the additional money to have one built into the radio. Fortunately, a 4 to 1 balun can be easily home brewed as illustrated in Figures 1 and 2.

Figure 1 shows a bifilar winding on a toroid. The toroid should be type 2 (red) material and can be any of the following sizes but the number of bifilar turns should be adjusted accordingly:

TOROID NUMBER OF TURNS POWER RATING

| | | |
|---------|----|------------|
| T80-2 | 25 | 60 Watts |
| T106-2 | 16 | 100 Watts |
| T130-2 | 18 | 150 Watts |
| T157-2 | 16 | 250 Watts |
| T200-2 | 17 | 400 Watts |
| T200A-2 | 13 | 400 Watts |
| T400-2 | 14 | 1000 Watts |

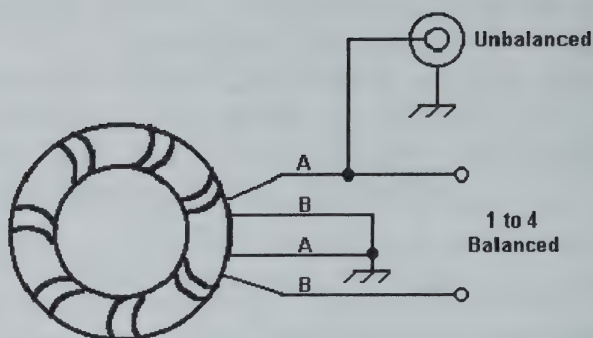


Figure 1

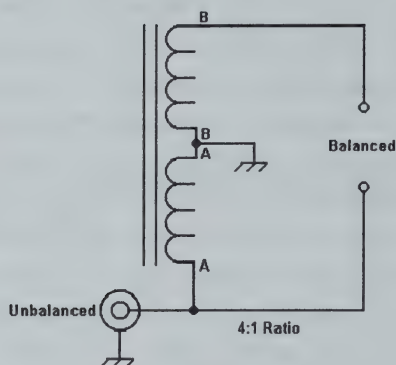


Figure 2

The exact number of turns is not critical but the numbers listed in the preceding table should yield optimum results. It is possible to exceed the power ratings listed above but the performance of the balun may be degraded during high SWR causing heating of the core.

Toroids of this type are available from Palomar Engineers, P.O. Box 462222, Escondido, CA 92046 (1-800-883-7020).

The balun should be housed in a suitable metal enclosure such as those available at Radio Shack. Use a SO239 or BNC connector for the unbalanced input. Nylon binding posts such as RS 274-662 work just fine for the balanced output.

DE N1HFX

Five Watt Dummy Load

by Monty Northrup, N5FC

This is another variation on the "parallel resistor" dummy load. This is one I built during my infatuation with copper pipe. It's perfect for QRP HF operation of 5-watts or less average power, and should be adequate for continuous operation at



that level. It's light and compact, about 2-1/2" in length overall.

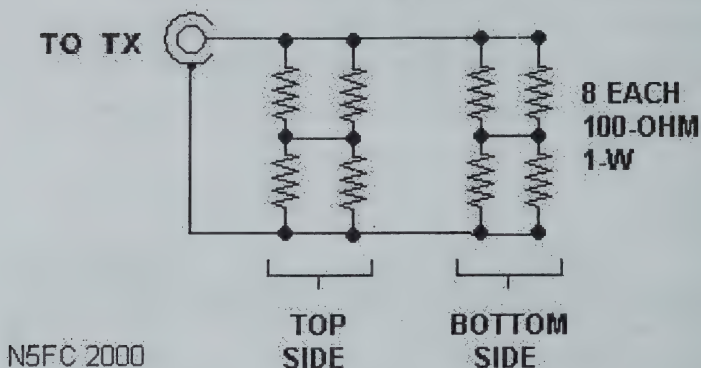
WARNING!

Dummy loads dissipate energy by generating heat. Heat generated in a small space translates to temperature rise, and temperatures can be hot enough (under the right circumstances) to burn people and ignite adjacent materials. Because of the thermal mass of the dummy load and its enclosure, that heat can stay around for a long time. Always locate your dummy load in a safe place, where there is no chance that it will burn people or catch something on fire.

The 1/2" copper pipe provides a convenient, compact form factor, is an excellent shield, and helps to dissipate heat to the outside world. Copper end-caps, available at most any hardware or plumbing supplier, provide a means of mounting the UG-1094 BNC jack and closing the unit.

This version uses 8 each 100-ohm 1-watt 5% metal-

QRP DUMMY LOAD

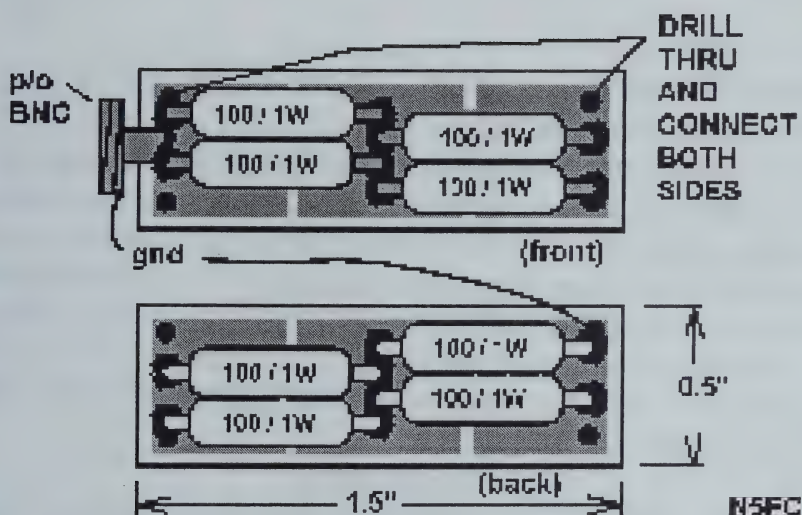


oxide resistors. Available from Radio Shack for a mere 25-cents each (RS 271-152), you'll invest all of \$2 for the parts. The resistors are good through the HF range, but don't do particularly well at VHF. Here's a schematic:

We'll fabricate a printed-circuit board from scrap double-sided copper board, cut to 1/2 x 1-1/2-inches, and grooved to form 3 pads on each side. On the top side, we'll mount 4 of the 8 resistors, and on the bottom side we mount the remainder. Simply tack-solder the resistors to the board. At the pads on the ends, we drill a small hole through the board, and solder a wire in place top-to-bottom. On the top side, we end up with a 100-ohm, 4-watt equivalent resistor (a pair of parallel 100 ohm resistors makes 50 ohms, and two pairs in series make 100-ohms). When we join the top and bottom in parallel, our equivalent resistance is 50-ohms (two 100-ohm quads in parallel).

Here's a sketch of the pc-board layout:

Mount the UG-1094 BNC Jack in one of the copper end-caps. Then, connect the pc board assembly directly to the center post of the BNC connector, soldering same. Connect the far end of the board to the BNC ground post, via a short



piece of bare wire. Wrap the entire pc board assembly liberally with plumber's teflon tape (available for a buck in the plumbing section of any hardware store). Then run the bare wire outside the teflon tape. DO NOT use other types of tape (they *will* melt!). Next, we slide a short piece of 1/2-inch copper tubing over the assembly, slipping it into the BNC/end-cap. At this point, an ohmmeter should verify 50-ohms. Finally, mount the other end-cap to close and shield the unit. Drill and tap a screw into both end caps to connect the shield both electrically and mechanically.

When supplied RF power for an extended time, this dummy load can get quite warm, even with just 5 watts. Be aware, and plan for it. (Read the "WARNING!" above). My version has an SWR of 1:1 throughout the HF range (DC to

30 MHz). Another variation of this, that includes an rf detector for measuring power is in the following article
73, Monty N5FC

QRP Dummy Load With Built-in RF Detector

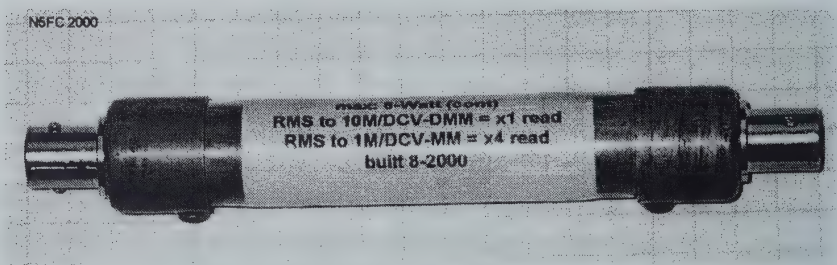
By Monty Northrup, N5FC

This is yet another variation on the "parallel resistor" dummy load. This is another one I built during my infatuation with copper pipe. It's suitable for QRP HF operation of 5-watts or less average power, and should be adequate for continuous operation at that level. It's light and compact, about 5-inches in length overall. This one is unique in that it has a built-in RF detector, with scaling, that may be used with your DC Voltmeter to measure power.

WARNING!!!!

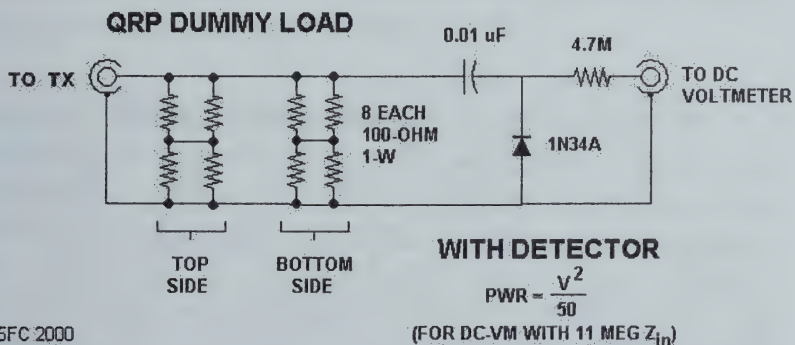
Dummy loads dissipate energy by generating heat. Heat generated in a small space translates to temperature rise, and temperatures can be hot enough (under the right circumstances) to burn people and ignite adjacent materials. Because of the thermal mass of the dummy load and its enclosure, that heat can stay around for a long time. Always locate your dummy load in a safe place, where there is no chance that it will burn people or catch something on fire.

The 1/2" copper pipe provides a convenient, compact

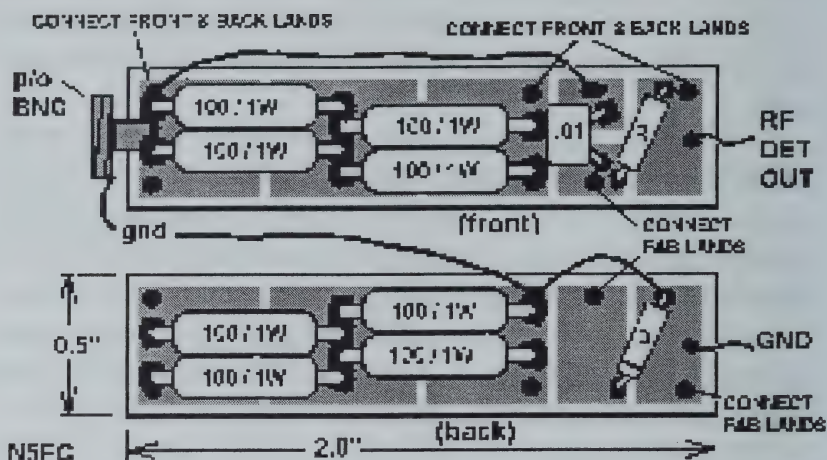


form factor, is an excellent shield, and helps to dissipate heat to the outside world. Copper end-caps, available at most any hardware or plumbing supplier, provide a means of mounting the two UG-1094 BNC jacks and closing the unit.

This version uses 8 each 100-ohm 1-watt 5% metal-oxide resistors, available from Radio Shack for a mere 25-cents each (RS 271-152). All the detector parts (yes, all three of them, a 0.01 capacitor, a 4.7-Meg resistor, and a 1N34A diode) are also available at Radio Shack. You would be hard-pressed to spend much more than \$5-6 dollars on this project. The resistors are good through the HF range, but don't do particularly well at VHF. Here's a schematic:



We'll fabricate a printed-circuit board from scrap double-sided copper board, cut to 1/2 x 2-inches, and grooved to form pads on each side, as shown in the layout below. On the top side, we'll mount 4 of the 8 resistors, and on the bottom side we mount the remainder. Simply tack-solder the resistors to the board. Where required to connect the resistors, we drill a small hole through the board, and solder a wire in place top-to-bottom. On the top side, we end up with a 100-ohm, 4-watt equivalent resistor (a pair of parallel 100 ohm resistors makes 50 ohms, and two pairs in series make 100-ohms). When we join the top and bottom in parallel, our equivalent resistance is 50-ohms (two 100-ohm quads in parallel



Mount a UG-1094 BNC Jack in each of the two copper end-caps. Then, connect the pc board assembly directly to the center post of the BNC connector, soldering same. Make all other interconnections with teflon-insulated wire. **DON'T SUBSTITUTE OTHER INSULATIONS!** Sorry, I know teflon wire is tough to find, but other insulation types will almost certainly fail when the resistors get hot. Wrap the entire pc-board assembly in teflon tape (often called plumber's tape, available at any hardware store. **DO NOT** use other types of tape (they *will* melt!). Next, we slide a short piece of 1/2-inch copper tubing over the assembly, slipping it into the BNC/end-cap. At this point, an ohmmeter should verify 50-ohms. Finally, solder the detector output wires to the second BNC, and mount the other end-cap to close and shield the unit. Drill and tap a screw into both end caps to connect the shield both electrically and mechanically.

When supplied RF power for an extended time, this dummy load can get quite warm, even with just 5 watts. Be aware, and plan for it. (Read the "WARNING!" above). My

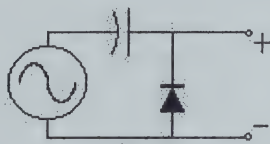
version has an SWR of 1:1 throughout the HF range (DC to 30 MHz). Measuring power is easy, and accurate if the detector's resistor is sized to work with your DC Voltmeter's input impedance. Read the DC Voltage, square it, and divide by 50. Example: we read 10 Volts, which is $10 * 10 / 50 = 2$ watts.

What's an RF probe, and how does it work?

You might think of an RF probe as a special test lead that converts your regular old' DC voltmeter to a RF reading voltmeter. Why not just read it using your trusty voltmeter, set on AC? Well, because most voltmeters won't read AC signals having a frequency above 10 or 100 kHz, and RF is way above that. [You can buy special RF-reading voltmeters, but they're very expensive... a homebrew RF probe is dirt-cheap]. Let's examine how an RF Probe works.



Classic Peak Rectifier



Simplified RF Probe

Above left, we see the schematic of a classic half-wave peak rectifier, commonly seen in power supplies. Its purpose is to take an AC signal at the input (usually from a transformer or the AC line), rectify it, and charge a capacitor. If you don't take a lot of power from the circuit (i.e., if your load doesn't draw a lot of current), the capacitor charges up to the peak voltage of the AC signal, and stays pretty much constant. Notice the simplicity of the circuit: not counting the load, we see it is an AC Source, a diode, and a capacitor in series.

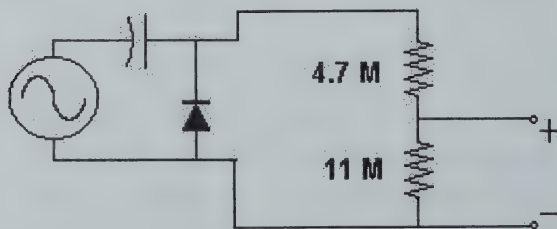
Above right, we see a simplified schematic of the RF Probe. At first glance, it looks quite different from the circuit at the left. But notice: just like the first, it consists of an AC Source, a diode, and a capacitor in series. Its purpose is to take an AC signal at the input (usually from a circuit under test), rectify it, and charge a capacitor. And just like the first

circuit, If you don't take a lot of power from the circuit (i.e., if your load doesn't draw a lot of current), the capacitor charges up to the peak voltage of the AC signal, and stays pretty much constant.

What's the difference between these two circuits, then? One small little thing, really. In the first circuit (the half-wave peak rectifier), any *positive* DC component gets added to the voltage at the output. In the second circuit (the RF Probe), the circuit is insensitive to *positive* DC components. This is good for an RF probe, because we're going to be testing circuits with DC biases applied, and we don't want those biases to affect our readings (we're interested in the AC only, i.e., the RF)

In both these circuits, if we place a DC (not AC) voltmeter at the place where it says "+" and "-" we'll read a DC voltage that is approximately equal to the *peak* of the applied AC voltage. If we knew our applied AC was a sinusoidal signal (or sine wave), then we could divide our reading by 1.414 to obtain the RMS value, which is the way we usually measure AC voltages. Even if it's not a sinusoid, at least we know what the peak voltage is, and that's something we didn't know before we started.

We'll do one more little trick to make the RF Probe more useful, and it will only cost us the addition of a 2-cent resistor. So that we don't have to manually divide our readings by 1.414, we'll use a resistor to create a voltage divider that will do it for us. Here's a classic voltage divider, added to our RF Probe circuit:



As we know from elemental electronic theory, the voltage across the second resistor (where it says “+” and “-”) is equal to the applied voltage multiplied times the ratio of the second resistance divided by the total resistance in series. In our case, for a sinusoidal input, we know the applied DC voltage is equal to the PEAK of the AC voltage. We would like the resistor divider to divide by 1.414, which means that the total resistance in series (including the second resistor) needs to be equal to 1.414 times the second resistance. In our example circuit, shown above, the second resistor is 11 Megohms, and the total series resistance is 11 Megohms PLUS 4.7 megohms, or 15.7 Megohms. Is this ratio 1.414? Pretty close, about 1.427, closer than the typical resistor tolerances.

But wait! I said we would add one resistor, not two! What’s up with that? Well, the 11 Megohms is the typical input resistance of a high-impedance voltmeter, like an electronic VTVM or a digital voltmeter. As long as it’s 10-11 Megohms, it’ll give results close enough for government work (HI). Obviously, it’s important to know what your voltmeter’s input resistance is, and you can find this out in your voltmeter’s specifications, or measure it (I wont get into that). And really, accuracy is often not that important, especially when you’re signal-tracing.

73, Monty N5FC

QRP Operating

By Richard Fisher, KI6SN
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Your QRP Accent, And What to Do About It

A few weeks after receiving my Novice license in 1965, an envelope arrived in the mailbox containing a small, quarter-folded pamphlet headlined: ***Your Novice Accent, And What to Do About It.***

Written by Keith S. Williams, W6DTY, it was a reprint of an article that first appeared in the November 1956 edition of QST magazine. I suspect that at the time, all newly licensed Novices around New England were sent a copy.

'DTY expressed concern about "a new accent, a new dialect" that was beginning to be heard in the Novice portion of 80- and 40-meter CW. After all, we tenderfoot CW ops were confined to a fairly narrow frequency window, crystal controlled with, for the most part, only each other to talk to. It's only natural, Williams surmised, that "people speak a language with the same accent as those with whom they live and work. New hams pick up habits and operating procedures of the gang they chew the fat with."

"Your Novice Accent" was an antidote to poor CW operating practices 'DTY was hearing. A primer on avoiding the pitfalls and bad habits befalling all too many Novices at the time.

While that original quarter-folded pamphlet was lost in the shuffle of life in the shack of WN1DWL back in '60s, I managed to run across another printed copy of the article some years later and occasionally re-read it. It's a refresher of the back-to-basics practices and procedures that can make a good CW operator even better.

If you'd like to see 'DTY's original article for yourself, visit this Internet address: <http://www.qsl.net/ae9k/novacnt.html>

With the passion I have for low power operation, I've been regularly hanging around the CW QRP frequencies for nearly 40 years. And for many of those years I've been thinking about the concerns expressed by 'DTY in "Your Novice Accent." Do you suppose we low power enthusiasts run the same risk? "Your QRP Accent?"

There seem to be some operating procedures that are - for better or worse - somewhat habitual in the common CW QRP neighborhoods.

The Great 'CQ' Debate

To "CQ" or not to "CQ" - that's the question. Heaven knows where the notion might have germinated, but many years ago someone atop the mount sent forth the dictum that if you're running 5-watts or less, it's fruitless to call "CQ." Not just fruitless, but wrong.

Perhaps the theory was that the other guy looking for a CW contact shops around for the strongest signal on the band. So anything less than 599 is out of the running.

How silly. I've got a pile of logbooks full of contacts stemming from "CQ de KI6SN."

Put yourself in the place of "the other guy." There's an S-9 "CQ" pounding into your receiver but you can hardly copy a callsign. His fist is so poor you've got to figure out if he's sending an "E" and an "M" or that his dit and dah spacing is so bad, he's really just sending the letter "W." A few kilohertz down the band is an S-7 station sending "CQ" and his callsign in perfectly formed CW. Which fellow are you more likely to choose to chat with?

Making the QSO experience as pleasant as possible for the receiving station is absolutely key. Easy-to-read CW at any signal strength is certainly a big plus.

"CQ?" By all means. It's a great way to make QRP

contacts. You'll know pretty quickly whether band conditions favor your strategy or not. But don't listen to those who say for QRPers, sending "CQ" under any circumstance is a mistake. Take it from a near 40 year QRP veteran: They're full of baloney.

Signing " / QRP"

Justified or not, some QRO operators look upon another station's pronouncement that it is at low power as an indictment of any power above 5-watts: "If you're being heard at QRP levels, I must be a terrible person for running my TS-140 at 100 watts."

If you think about it, nothing could be further from the truth. Any bloke can put a 2-watt CW signal into the ether. It's the superlative skill of the RECEIVING operator who makes the QRP contact happen. A terrible person? Certainly not.

But remember that flashing your QRP moniker gratuitously can send an unspoken message you may not want to be dispatching.

That said, however, I've found that by politely asking if the other guy, for the fun of it, would like to reduce his 100 watts to, say, 10 watts, he's more than eager to try.

He's often amazed to hear that his 10-watt signal is just as readable as his 100. Then I suggest going to 5 watts, then 2 watts, 1 watt, and then into the milliwatt level. "How can you be hearing me?" they sometimes ask in disbelief. "I'm not even moving my output meter here." Talk about fun. And educational.

But back to the fundamental issue: Is it necessary for "KI6SN / QRP" to be part of my "QRP accent?" In the vast majority of cases, I'd say it's not.

For casual operation, the guy on the other end is merely looking for someone to have a nice conversation with. Your power level isn't really an issue. The quality of your signal and CW is, though.

DX chasing is another matter, however. Seasoned veterans have suggested over the years that in pile-ups, it's sometimes to the low power operator's advantage to sign " / QRP." This gives the DX station a heads-up that a QRPer is in the pack.

It's then the DX station's option either to act upon that bit of additional information, or ignore it. The QRPer will learn pretty quickly if the foreign station is willing to ask other stations to standby so a low power signal can briefly be given the floor.

In all cases, I'd recommend that " / QRP" be used with great forethought and prudence. It's not the kind of postscript you want to wag around haphazardly. Do that and you run the risk of sending that wrong, unspoken message to everyone listening on the band.

Department of Redundancy Department

There's frequently a tendency on the QRP operator's part to assume that the receiving station is struggling to hear his signal. Craning an ear toward the speaker, he strains to pull the low power station's CW from the din.

Experience tells us, though, that for rank-and-file QRPer's this is far more the exception than the rule. Most contacts are made with each station comfortably copying the other.

So, what possesses some QRPer's to act upon the urge to routinely repeat information?

"AGE HR IS 52 52 52 52." Jeepers, I'd given him a 579 RST. That's pretty darned readable in my book. And I got his age just fine the first time. It's highly unlikely he's 52,525,252 years old, so why's he wasting my time and his energy by sending it four times?

With a 579 or even a 549, it's OK to have confidence in your signal and in the ability of the operator at the other end to copy. Believe me, if your signal is failing or the other operator's skills are lacking, you'll most likely hear

about.

It's not fair for the QRPer to merely assume the other station is struggling. The net effect of unnecessarily repeating things is often frustrating the receiving operator and sending an unspoken message to him: You're not very confident that he's up to the task of handling a QRP signal.

That can be interpreted in lots of different ways - including arrogance. Is that the impression you want to leave with your fellow radio amateur? Let's hope not.

Bottom line: Unless the other station makes it clear that he's having problems copying you, assume he's not. And, in your best CW, converse as though he's hearing you fine, sitting right across the room.

"Let's talk about me. . ."

We all know the thrill of making contacts across thousands of miles with a lot less power than it takes to light the bulb in your refrigerator. That's one of the thrills of QRP. Every contact is an adventure. But what's thrilling to us needn't always be the center of attention in a CW QSO.

Indeed, some of the radio amateurs on the other end are genuinely fascinated by your QRP signal. They may have lots of questions about your station and your antenna. How you got started and your best DX.

Don't, however, assume that that fascination is universal. Face it, there are thousands of QRPers around the world. They are avid CW operators and really "get around."

The chances are fairly good that the guy you're QSOing has already talked with other QRPers. You're not the first, nor will be the last. So this business about getting out with 5 watts isn't such a startling revelation or a big deal.

If questioned about your low power exploits, by all means describe them. But if that's not happening, it's OK to be curious about the other operator, In other words, "Let's talk about you. . ."

Some of my most enjoyable, interesting and memorable contacts have made only passing reference to QRP. In fact, there are dozens of instances where the output power of my station was never even mentioned.

Yes, QRP operation can be a great conversation piece. But it's not the only one. It's OK to be curious about the other guy's station layout and antenna. His occupation. His family. His QTH. His other interests. There are some darned interesting people on the air who don't have the slightest interest in QRP. And that's OK. How boring our airwaves would be if we were focused on just one topic.

Tuning around

It may be a throwback to the days when most of us were "rock bound" with crystal controlled transmitters. But in my Novice days it was common practice after calling "CQ" to tune around the CW band for stations that might be answering you, but didn't have a crystal cut to your transmitting frequency.

With so many crystal-controlled transmitters in the QRP game even today, "tuning around" isn't a bad habit to acquire. Think about how many of the classic crystal-controlled Tuna-Tin 2 transmitters are regularly in use.

The TT-2 operator may hear you sending "CQ" a couple of kilohertz up the band and give you a call. Unless you've taken the time and exercised the courtesy of listening to either side of your transmitting frequency, chances are good you'll never make contact. That's a shame.

Even listening across the skirt range of the receiver incremental tuning - the RIT found on most of today's transceivers - is a good thing.

If you're the guy with the VFO, it's perfectly OK - even preferable - to zero beat the crystal-controlled station's frequency.

By doing so, you're taking up less of the band for your QSO by being on the same frequency as your QSO

partner. At the same time, except for short pauses as you turn the conversation over to the other station, you're signaling constantly to oncoming stations that your frequency is in use.

For heaven's sake, take a breath

Especially in times of erratic sunspot activity, band conditions can change in a matter of seconds. That S-9 signal you're comfortably copying suddenly drops off the end of the table, and you're fighting to pull him out of the noise.

That's one of the main arguments for keeping your transmissions relatively short. Rambling conversations run the risk of getting "timed out" by changing propagation.

There are few things more embarrassing to me as an operator than to have waxed elegantly, albeit longwindedly, about something I think I'm very smart about, only to turn the conversation back to a guy who lost me in the noise five minutes earlier.

Using frequent breaks is a fine CW operating procedure to counteract the effects of fast-changing conditions. For example, instead of asking three questions on three separate subjects and then turning it over to the other guy for response, ask just one question and "break" the conversation: "What feedline are you using? BK" The other station then answers in a similar staccato manner: "600 ohm open wire. BK." It's tantamount to taking a breath during day-to-day conversation.

This way if the band starts "going south," the other guy can let you know right away. Similarly, you can notify him that you're having problems.

If you're carrying on about something for four or five minutes, it may be too late for you to react. You're left with a busted QSO and a nagging curiosity: "I wonder how much of that he actually got?"

Lasting impressions

In the lexicon of American Indian wisdom there is a saying that "We will be known forever by the tracks we leave."

As a member of the QRP community, I often wonder what impression I've left with the last fellow I QSO'd. How was my CW fist? Was the quality of my signal something I'd be proud of? Was I a good listener? If the going got rough, was I skillful? Was I patient? Was I understanding? Was I at all times a gentleman?

If the other guy was viewing the entire QRP community through his QSO with me, have I shown our colors well?

As one low power enthusiast among many, I hope that my "QRP Accent" is one that admirably represents the QRP community and radio amateurs at large.

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